ELECTRICAL REVIEW

June 6, 1947

Managing Editor :
Hugh S. Pocock, M.I.E.E.

Technical Editor :
C. O. Brettelle, M.I.E.E.

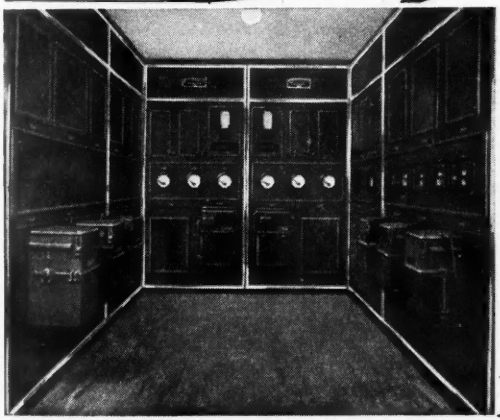
Industrial Editor :
J. H. Cosens

Contents :—

	Page
EDITORIAL—Industrial Power Supply	921
ARTICLES—	
Light Metal Extrusion	923
Cold Snaps and Power Plant. By "Electricus"	931
Standard Overhead Lines. By John McCombe, Ph.D., A.R.T.C., M.I.E.E.	938
Acidity and Sludge. By J. A. Clegg, M.Sc. (Eng.)	947
REPORTS—	
Materials for the Supply Industry	928
Joint Authorities' Meeting	935
Scottish Water Power	935
Royal Society's Soirée	941
Power Engineers' Conditions	942
Mechanical Engineering Research	942
REPORTS—*continued*—	Page
Scottish Sales Conference	950
Illuminating Engineering Society	952
Industrial Research	958
NEWS SECTIONS—	
Personal and Social, 933 ; Commerce and Industry, 943 ; Electricity Supply, 951 ; Financial, 953 ; Contracts, 959.	
VIEWS ON THE NEWS	929
NEW BOOKS	930
CORRESPONDENCE	936
RECENT INTRODUCTIONS	937
NEW PATENTS	957
NEXT WEEK'S EVENTS	960
Classified Advertisements	59
Index to Advertisers	88

EDITORIAL, ADVERTISING & PUBLISHING OFFICES : Dorset House, Stamford St., London, S.E.1
Telegraphic Address : "Elecrev, Sedist, London." Code : ABC. Telephone No. : Waterloo 3333 (50 lines).
Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage. Entered as Second Class Matter at the New York, U.S.A., Post Office.
Annual Subscription, Post free : Great Britain and elsewhere (except Canada), £2 7s. 8d. ; Canada, £2 3s. 4d.
Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW LTD., and crossed "Lloyds Bank."

DENNIS SWITCHBOARDS FOR EVERY PURPOSE



Dennis Switchboards and Control Units of all types are being produced for installation in all parts of the world—on land, at sea and in the air—for Consulting Engineers, Govt. Depts., Power Supply Authorities, large industrial concerns and undertakings of every type.

●

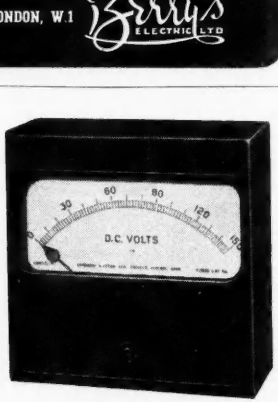
IRONCLAD INDUSTRIAL AND CUBICLE SWITCHBOARDS SKELETON AND FLAT BACK TYPES • SUBSTATION L.T. SWITCHBOARDS FEEDER PILLARS • IRONCLAD FUSE AND SWITCH GEAR

G. P. DENNIS LTD. FLEMING ROAD, SPEKE, LIVERPOOL
Phone : Hunts Cross 1217/8 Grams : "Desco, L'pool"

CVS-14

...Here is one Space...
...which only a Berry's Decorative Lighting Fitting can fill—we know of many more.
TOUCHBUTTON HOUSE, NEWMAN ST., LONDON, W.1
Berry's ELECTRIC LTD

NEW WESTON DEVELOPMENTS



No. 7. ***Rectangular Switchboard Instruments***

These new rectangular switchboard instruments are becoming increasingly popular and are offered as an alternative to the well-known Weston round patterns. They are available in the D.C. Moving Coil, A.C. Rectifier and H.F. Thermocouple Types and are built in a wide variety of ranges from values as low as 50 microamps D.C. All the instruments are magnetically shielded; they have 6-inch scales and are provided with spring loaded jewels to protect the pivots from shocks and to reduce friction to a minimum. They are supplied with first grade accuracy and comply with B.S.S. No. 89. Neat in design and pleasing in appearance, their rectangular cases are of moulded bakelite and are available in the projecting pattern only. Please ask for details of the Model S83.

SANGAMO WESTON LTD.

GREAT CAMBRIDGE ROAD, ENFIELD, MIDDLESEX. Telephone: Enfield 3434 & 1242

ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXL. No. 3628 JUNE 6, 1947 9d. WEEKLY

Industrial Power Supply

Undertakings' Charges to Private Plant Owners

WE reported recently that the Ministry of Supply was affording facilities for the manufacture of a large number of generating sets for industrial use as a means of relieving the electricity supply position.. Dealing with this matter in a letter to *The Times* last week, Sir Lynden Macassey, independent chairman of the British Internal Combustion Engine Manufacturers' Association, said that factory owners were being encouraged to purchase these sets by the removal of the tax on Diesel oil and an assurance of adequate supplies of oil, but they needed further assurance.

"Restrictive Practices"

It should be made clear that the scheme was not a mere emergency expedient and factory owners should be freed from "certain restrictive practices" of electricity supply undertakers. These practices included the requirement by some authorities that all electricity should be taken from them. Most of them charged a high price for stand-by or supplemental supplies. Sir Lynden Macassey contended that as factory owners who installed their own generating plant relieved the grid during normal working hours they should not have to pay more than the ordinary rate for power used after normal hours.

This is a matter which will be regarded somewhat differently by electricity supply authorities. Generally the rates which they have quoted for power have been contingent upon a guaranteed consumption (or revenue) to reimburse them in respect of costs incurred in mains extensions and to cover the capital charges on that proportion of their plant which is at the factory owners' constant service.

While the cable costs remain, it is true of course that the supply authority's plant (which may be presumed to be fully- or over-loaded) is relieved to the extent of the factory's private generating plant capacity. Nevertheless plant still has to be available on the public system to meet any emergency call from the factory or to serve the factory during the overhaul of the private plant. But it can be argued by factory owners that it is extremely unlikely that all their plants will break down simultaneously or be out for maintenance at any one time. Therefore there is an offsetting diversity of which account should be taken.

Stand-by Costs

If there were no public supply to act as a stand-by, industrialists would have to safeguard themselves against stoppage of production through the breakdown of their generating plant or be prepared to bear perhaps serious losses. The risk might possibly be taken during the earlier years of their plant but the tendency to run such sets to a standstill would mean that eventually there would have to be a second set to fall back on in a likely emergency. Therefore the industrialist should at least be prepared to pay the supply authority the equivalent of the capital charges on a hypothetical stand-by set.

Naturally the factory owner will not wish his overall power costs to be increased

by the installation of his own generating plant. Relief might be given in the form of more generous depreciation allowances on the plant for income tax purposes, particularly as in a growing business extensions will be necessary and generally a reversion to public supply may be envisaged when the present emergency is past. We have stated some general considerations, but the whole matter is so complicated that only a committee representing the interests involved could work out equitable terms. As about 300,000 kW of plant is said to be involved it is necessary that something should be done about it at once.

Copper Position

AMID the continuing reports of shortages in all kinds of materials it is pleasing to hear of the possibility of an easing so far as copper is concerned. The latest reports from Chile and the United States are of substantially improved production and it is believed that American imports of the metal may conceivably be reduced—to the advantage of other buyers. One important result of the narrowing of the gap between demand and production will be the halting of the upward movement in the price of copper which now stands at £137 per ton, as compared with round about £50 eight years ago. This is an important consideration to such a large consumer as the electrical industry especially in estimating for forward contracts. Customers do not like price adjustment clauses.

German Revival

ONE of the few ostensible gains from the war was the freeing of the British electrical industry from German and Japanese competition which was often of a doubtful character. It is becoming obvious that the disappearance of our two enemies from world markets can be only temporary. Unless German industry is allowed to revive sufficiently to enable the country to pay for its imports British and American (and perhaps Russian) taxpayers will have to continue to carry their present enormous burden to keep Germany going. Therefore it must not come as a shock that the occupation authorities have decided to encourage German export trade in a number of directions—including electrical products. We must ensure, however, that German electrical industry follows the right lines and that its revival will not mean a recurrence of the unhealthy competition which leads to trouble.

Overhead Lines

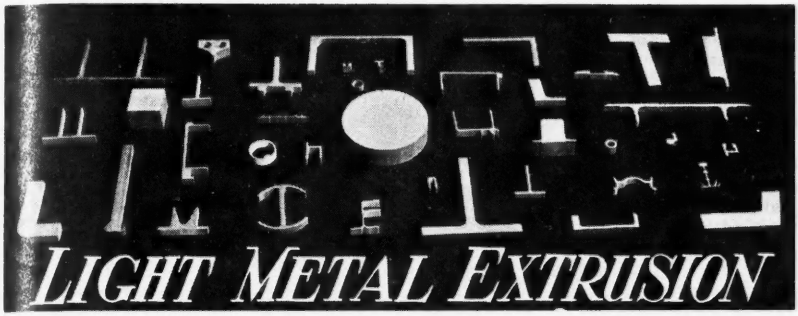
ALTHOUGH the complete electrification of rural areas, announced as the intention of the Government, is likely to be greatly delayed owing to the present difficulties in securing imports of poles, the preparatory work needed will occupy much of the intervening time. The magnitude of the task is illustrated by the probability that the mileage of overhead lines necessary to supply the remainder of the 25 per cent or so of reachable premises will exceed that already in existence. With that in view the publication by the Electrical Research Association of a review of its work on overhead-line materials and design during the past twenty-six years (F/T 170) is most opportune, particularly in regard to special problems, which vary from place to place.

Soot Blowing

CONFLICTING views on the desirability of using soot blowers regularly are summarized in the newly published Technical Paper of the Boiler Availability Committee. It seems possible that the size of the adverse opinion owes something to numerous instances of successful routine operation of the blowers being taken as a matter of course. Where soot blowing appears to aggravate external deposit troubles as well as waste steam, the recommendation seems reasonable that the system should be thoroughly overhauled and retried before abandonment.

Electro-Mechanics

So necessary is a grasp of mechanical engineering principles to electrical engineers, many of whose problems fall within this category, that the formation of the research organization referred to in this issue is of direct interest to our own industry. Of the many basic investigations of this kind, those into the behaviour and properties of metals at high temperatures, which influence profoundly power station efficiencies, may be cited as an illustration. The results of fundamental research are not often forseeable, but Dr. Hankins, the director, envisages supersonic flow round the blades of steam turbines as a future possibility.



LIGHT METAL EXTRUSION

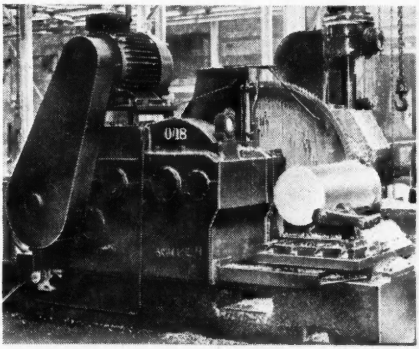
Industrial Heating Applications

AT the factory of Birmetals, Ltd., at Birmingham, we recently saw the major electrical applications to the production of "Birmabright," magnesium-aluminium alloys in the form of extruded bars of all manner of sections which are supplied to other factories as raw materials for the production of a very wide range of goods, including building structural members, architectural decorative devices, window frames and fittings for houses, shop fittings, non-corrosive members and fittings for marine use, aircraft frames and members, automobile-window sections and cycle rims. Some examples of the intricate shapes available are seen in the photograph above.

The raw materials for the Birmetals factory are pure aluminium ingots with an average weight of about 28 lb, and various alloying elements which impart strength and other desirable qualities to the products. From the essential production point of view the feature of prime importance is the precision analytical control of the materials at this early stage.

In the desired proportions the materials are melted in coke- and oil-fired reverberatory furnaces which hold about 15 tons of molten metal and yield about 1½ tons per hour each. The molten metal is usually poured into ladles, and after being fluxed it is converted into billets of sizes and shapes suitable for later processing. The billet-casting moulds are disposed vertically in a pouring table and are water-cooled by external spraying. A pumping station housing a total of about 180 h.p. of motor-driven pumps will provide up to about 1,500 gallons of water per minute for the recirculatory cooling water system which embraces external fan-cooled equipment.

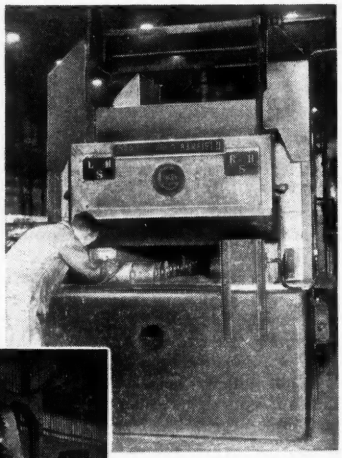
The billets are sawn into suitable processing lengths, and to cite one sawing machine which will deal with billets up to 24 in. in diameter, the 5-ft diameter saw blade which travels at 268 r.p.m. is driven by a 1,000-r.p.m. motor with 3 to 1 belt transmission to a gear box which engages the saw-blade shaft.

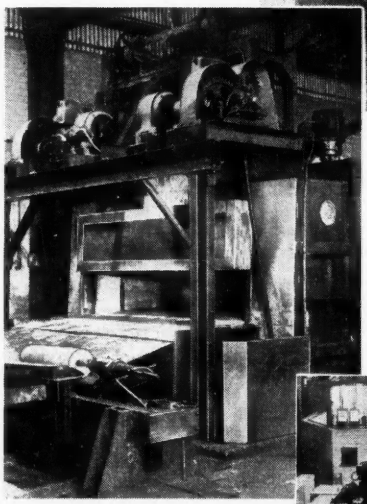


Billets are sawn into suitable processing lengths; 5-ft dia. saw blade, about 18-in. diameter billet

After careful inspection and chemical analysis the sawn billets are dealt with in the extrusion department where the first operation is preheating. We saw a considerable number of resistance furnaces produced by G.W.B. Electric Furnaces, Ltd., engaged on this work, with internal gravity, conveyor, and pusher work-travelling arrangements, and varying in sizes and electrical loadings

according to the sizes of the work dealt with. One such double-conveyor preheating furnace which deals with billets about 30 in. long and 12 in. in diameter has a capacity for eighty billets. The 375-kW loading affords chamber and work temperatures of up to 520 deg C and 470/480 deg C respectively. The wall- and roof-mounted heating elements are arranged in three zones with separate automatic controls by means of Kent apparatus on a central control panel, which operates on the fixed- and moving-pointer principle and is governed by pyrometers in the heating chamber.

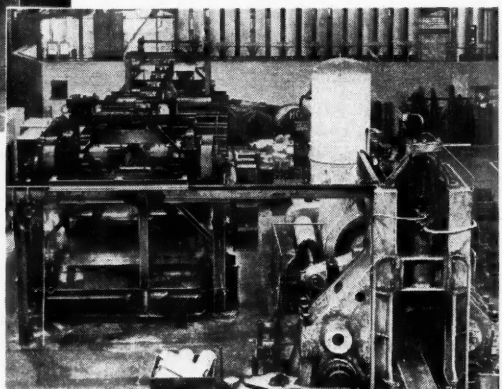




This 90-kW preheating furnace (right) will take 130 3-in. billets

Motors on the furnace roof transmit to the conveyor chains through reducing gears, sprocket wheels and crank motions, and the doors are raised and lowered under motor power. At the delivery end the preheated billet rolls out and down a ramp into a V channel arranged normally to the furnace line. A motor-driven pusher, with conveyor-chain transmission and limit-switch stopping control, then passes the billet along the channel ready for delivery to the extrusion press. For dealing with smaller billets of about 3 in. in diameter and 16 in. long a similar but smaller furnace has a holding capacity of 130 billets. The loading is 90 kW and the working conditions are about the same as those of the larger equipment.

Generally each preheating furnace works in association with a particular extrusion press, although in some cases two furnaces serve one press. The 375-kW furnace for 12-in. billets referred to above operates in conjunction with a 3,000-ton press, while the smaller one mentioned, for 3-in. billets,

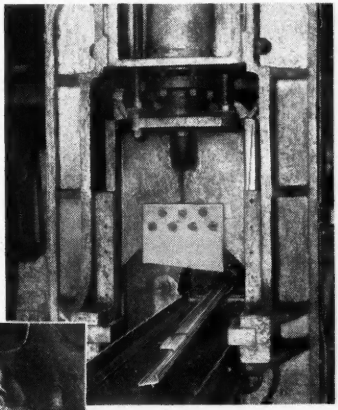


Above: At the delivery end the preheated billet rolls out and down into a V channel

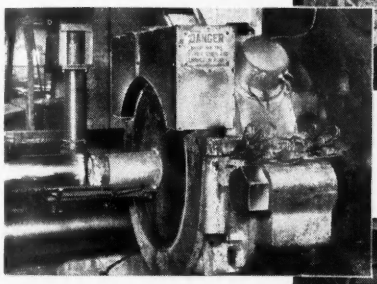
Right: Generally each preheating furnace works in association with a particular extrusion press

operates in conjunction with a 650-ton press. A 2,000/500-ton press is served by twin furnaces, each of the chain conveyor type and having a capacity for sixty billets (10 in. in diameter and 32 in. long) and a loading of 250 kW.

The billet arrives at the press in a " soft " condition, and the operation of forcing this through a die under a pressure of about 40 tons per sq in. is in principle rather like a combination of hot drawing and forging. The press consists essentially of a horizontal hydraulic cylinder and ram, an electrically heated container and the die, together with a charger, run-out table and



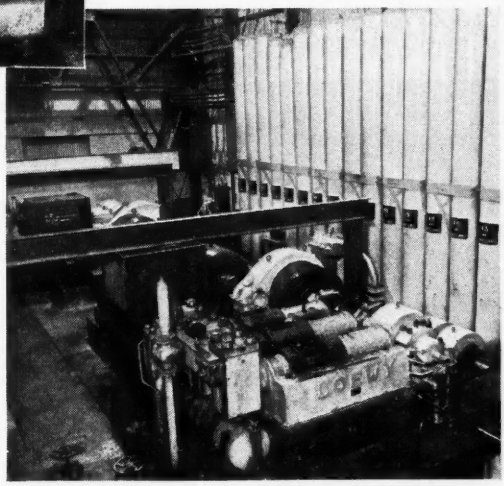
Elongated sections are received from the die on a run-out table



Heating elements are embedded in the housing of the press container ; note special lead-in arrangements on right and billet, pusher plate and ram on left

other ancillary equipment. The components are aligned so that the ram passes into the central hole in the container during extrusion; but first the die is assembled at the opposite end of the container by a " wedge." Then the billet is inserted, followed by a pusher plate, ready for the application of pressure by the ram. The elongated section, or sections, are then received from the die on the run-out table on the delivery side of the die.

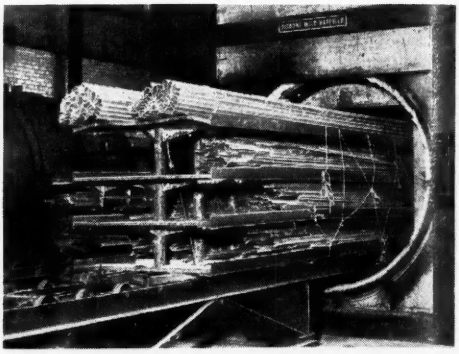
The container is heated so as to maintain the temperature of the hot billet immediately before and during extrusion. The container is supported in a housing which is in two heavy sections (top and bottom), bolted together, and the heating elements are actually embedded in the housing, near the interior surface, i.e., as near as possible to the container proper. The elements are of the mineral - insulation nickel-alloy sheathed type, as are the external connections to them on the exterior of the housing. In order to facilitate disconnection of the external connections to the elements when it is required to separate the two sections of the housing there is an arrangement of special connecting boxes with screw-on gland connections for the leads. The container heating load varies with the size of the press, but, to give one



The hydraulic station serving the two largest presses has three 350-h.p. synchronous motor driven 4,250 lb per sq in. pumps

example, the 3,000-ton press to which we have already referred has a container heating load of 70 kW.

There are a number of hydraulic stations serving the extrusion presses throughout the works, but it will be sufficient to refer only to one in detail. The station, which serves two large presses, one 3,000 tons and one 2,000 tons, is equipped with three Loewy three-throw horizontal-ram pumps which automatically maintain a pressure of 4,250 lb per sq in. in a hydraulic-pneumatic accumulator system comprising a large number of small-section vertically disposed cylinders. Each pump is driven by an E.C.C. 350-h.p. synchronous-induction motor which runs at 750 r.p.m. and transmits through pinion speed-reducing gear to give a speed of 120 r.p.m. at the pump shaft. The motor is started up under liquid-resistance rotor control, and it is separately excited after synchronous speed has been attained. During its operation period any one motor runs constantly, while the pump is loaded and unloaded automatically through suitable valves with the fall and rise of the pressure in the accumulator system.



Ageing is effected in 4-ton cylindrical horizontal furnaces with a traversing charging machine

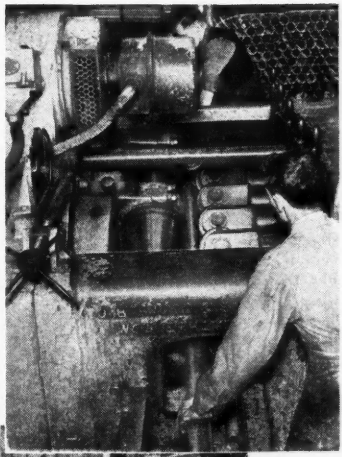
After being rough sawn to the approximate required lengths the sections requiring heat treatment at this stage are dealt with in one of the many salt-bath installations we saw about the factory. Each installation comprises the salt bath proper in which the sections are solution treated to improve the physical properties, alongside the quenching tank in which the sections are immediately hardened after removal from the bath, and an overhead travelling handling crane by which the section lengths are raised, lowered and transported in a suitable cradle.

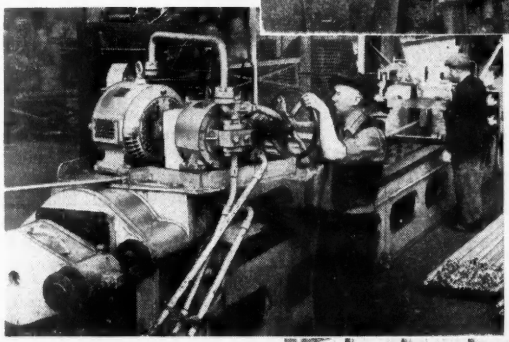
To refer in some detail to one of the salt bath equipments—an "Efco" equipment with a capacity of 30 cwt—the bath, which is 24 ft long and 4 ft wide, is heated by means of mineral-insulated nickel-alloy sheathed immersion heaters disposed around the inside of the tank walls, with a total loading of 420 kW. The operating temperature of up to 530 deg C is automatically maintained by means of Kent control instruments operating on the fixed- and moving-pointer principle and working in association with thermometers suitably disposed in the bath. The elements are arranged in four zones.

Each salt-bath installation comprises the electrically heated bath alongside the quenching tank and an overhead travelling crane

Some distortion is imparted to the sections during the processes described, and before or after the heat treatment the lengths are

straightened. This is generally done by treating the lengths in electric-oil-hydraulic stretching machines which vary in their operating pressures from 15 tons for light sections to 320 tons for heavy sections. The 100-ton stretcher which we illustrate deals with medium-size sections of up to 30 ft long. The section ends are clamped in fixed and movable heads, the fixed head being first electrically manipulated into the required position in which it is anchored to a heavy chain in the base of the machine. The movable head is then drawn away from the fixed head by means of the ram of the hydraulic cylinder at that end of the machine. The oil pump and its driving motor surmount the hydraulic cylinder.



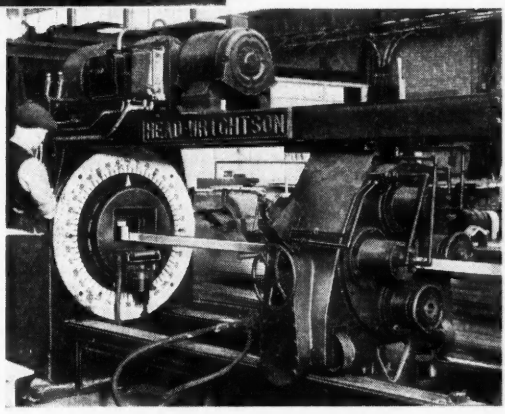


Above: Straightening on electric-oil-hydraulic stretching machines. Right: De-twisting is another straightening operation

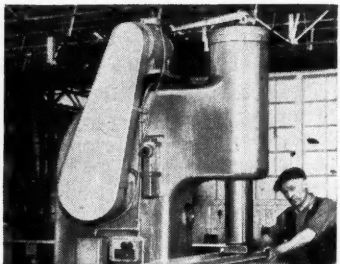
The motor runs constantly during the operation period and the pressure is applied to the cylinder and built up by closing a suitable valve in the hydraulic system. In some cases an "Electraulic" press is used for straightening. Here there is a vertical ram which bears down on the work between two fixed supports on which the work rests on the work-table. In principle this electric-oil-hydraulic machine is operated in a similar way to the straightening machine, the hydraulic pressure being 30 tons; the operating valve is actuated by a pedal.

The de-twisting process involves clamping the ends of the section between the stationary and rotating heads of a de-twisting machine. The motor surmounting the machine drives the rotating head either way through a very high ratio speed-reducing transmission system. The degree of the twist is measured against a suitable scale around the movable head. The exclusive treatment for straightening round bars is reeling, in which the bar travels longitudinally between two lines of rollers, one line power driven and the other line idle. The power and idle

Round bars are straightened by reeling



rolls are set at opposing angles, each of about 45 deg to the horizontal, i.e., to the rod, which is both propelled longitudinally and revolved by the power rolls which bear on it, while it also transmits to the idle rolls. The reeling machine cited has a straight electric drive, and the 45-h.p., 960-r.p.m. motor serves two 3 to 1 belt transmissions and, in turn, two enclosed gears from each of which one of the two power-rolls is driven at 120 r.p.m.



Another method of straightening

Some of the products are double heat treated, and the second ageing heat treatment takes place at this stage after the straightening operations. Ageing is effected in G.W.B. cylindrical horizontal furnaces, each of which has a charge capacity of 4 tons. The sections are loaded on a tiered rack which is passed into and out of the furnace container by a motor-driven chain conveyor embodied in an external loading skip which runs on rails so as to serve two furnaces. The elements are disposed all round the heating chamber between the refractory lining and the outer casing. The total loading is about 150 kW at 400 V and the operating temperature is 175 deg C. The temperature is automatically controlled within set limits by the switching of the elements in a manner similar to the controls of the other furnace already referred to. The element circuit is also automatically switched off and on with the opening and closing of the motor-operated drop-down door, independently of the normal control system. Finally, before dispatch, the sections are all sawn to the required lengths, and carefully inspected and tested for physical properties, weighed and packed.

We are indebted to Birmetals, Ltd., and Birmabright, Ltd., for permission to visit the works and to publish this article, and to the staff of the companies for co-operation in obtaining the information and taking the photographs.

Materials for the Supply Industry

Authorization and Issue of Licences

THE Electricity Commissioners have notified electricity supply undertakings that it has been decided that the authorization or the issuing of licences to acquire controlled materials and supplies for all the fuel industries and all priority questions relating thereto shall be concentrated into one organization and that as from June 2nd the Ministry of Fuel and Power will be the responsible Department in respect of the requirements of the electricity supply industry in such matters.

This arrangement will apply to:—

(i) all materials such as iron and steel (including broad gauge railway track) and timber (including wooden poles for overhead lines) for which a formal authorization or licence is required before they may be acquired or used;

(ii) other materials such as lead or copper not requiring formal authorization or licence but in respect of which difficulties may arise owing to their scarcity;

(iii) items within the scope of the Materials Priority Scheme referred to in the Commissioners' circular letter of May 17th, 1946;

(iv) miscellaneous items for which coupons or certificates are required, such as protective clothing, towels, industrial leather gloves, thigh boots and gum boots and cotton.

Applications and inquiries in respect of such supplies should be addressed to the Director, Priority and Materials Branch, Ministry of Fuel and Power, 7, Millbank, S.W.1. No renewed application to the Minister need be made in respect of any outstanding applications made to the Commissioners.

The Commissioners will continue to be responsible for the authorization of any building and civil engineering works for which any of the controlled materials may be required, and applications for authorization of such works under Regulation 56A of the Defence (General) Regulations should still be addressed to them.

Views on the News

Reflections on Current Topics

DURING the Bankside power station discussions the possibility of using an alternative site at Rotherhithe was canvassed but it was stated that, far from being a mere alternative, Rotherhithe would probably have to be an additional site for a new station. But even Rotherhithe is not untrammelled. It has (apparently) just been discovered that the land on which the proposed power station would be built already bears two blocks of flats, recently repaired, and is the site of a school which the Bermondsey Borough Council has asked the L.C.C. to rebuild. According to one of the councillors, when he made inquiries at County Hall he found himself "up against a curtain." It looks as though electricity is now likely to be in danger of being represented as an enemy of education as well as amenity.

* * *

It may have been true once that the role assigned to youth by its seniors was "to be seen but not heard." To-day, however, the younger members of our profession have not the same reason to complain of lack of opportunities to show their mettle. As an example, the Installations Group of the I.E.E. North Midland Centre (which already has a Students' Section) is reserving an evening next session for the discussion of three ten-minute papers which junior members are entitled to submit. Intending contributors are given the right to commandeer the assistance or advice of any member of the committee or call for lanterns or other lecture apparatus. The opportunity is theirs, it is pointed out; their effort is all that is required.

* * *

As the range of subjects covered by the term "electrical engineering" progressively expands, so does the dilemma become more formidable of reconciling a specialization that demands concentrated attention with a retention of ability to relate one's own work to that of others in the whole scheme of things. Glancing through the index of the last volume of the *Electrical Review*, I found upwards of a hundred subjects listed, proficiency in any one of which would require years of experience. This supports the contention of leading technical educationalists that junior members of the profession especially should be advised to take every opportunity of keeping abreast of developments in the whole field of electrical engineering. Aptitude for senior administrative positions implies ability to co-ordinate the work of many specialists in comprehensive schemes that have to take into account the possibility of fresh discoveries in physics, and to make new decisions as these discoveries come along.

* * *

Many local authorities are supporting the appeal of the British Electrical Development Association against the reimposition of purchase tax upon electric cookers, wash boilers and water heaters. Although the Chancellor of the Exchequer in his Budget speech described this as not a revenue-raising device but an attempt to put a brake upon the consumption of electricity, the tax will merely provide more money for the national coffers because these things are necessities and must be purchased by housing authorities and private individuals if they are to equip their new dwellings with anything more than the most primitive arrangements. The tax merely means higher rents for publicly-owned houses, while apart from these it penalizes the poorer buyers in favour of those who do not mind what they pay. It is not too late to rectify this mistake—for a mistake it is—and I hope that the Chancellor will be persuaded to alter his mind.

* * *

Mobility of labour is impeded at the moment by the general shortage of accommodation but that does not worry the National Coal Board which has acquired two or three mansions for the housing of senior officials. It is extremely unlikely that these gentlemen will have possession of the whole of the somewhat vast buildings which the Board has purchased, but the way in which the news was put out rather made it look as though they would. Why I mention this is that the new Electricity Authority and Boards will probably have to do the same thing and some aspirants to jobs in the new organization may find that their castles in the air have actually materialized.

—**REFLECTOR.**

NEW BOOKS

Electronic Circuit Textbook. Review of Plastics.

Fundamentals of Industrial Electronic Circuits. By Walther Richter. Pp. 569 + xviii; figs. 28. Index. McGraw-Hill Book Publishing Co., Ltd., Aldwych House, London, W.C.2. Price 22s. 6d.

This is an unusual book and one that merits study, not only by students of electronics but also by authors of electrical textbooks. This view is expressed because of the unusual clarity and simplicity of the exposition. The author never makes the mistake of " writing down " to his readers nor does he " baffle them with science."

Starting with the fundamentals of d.c. circuits, circuit theorems and power relations, the author passes on to inductance, capacitance, resistance and to their uses in timing circuits; a.c. is then dealt with, transformers and non-linear conductors follow, and then valves. After a chapter devoted to the general properties of valves (emission, space charge, etc.) diode rectifier and filter circuits are dealt with. Then comes the triode with its applications to the operation of relays, to the measurement of voltage and to bridge circuits.

Multi-element valves are described, as are multi-stage amplifiers, power amplifiers, cathode followers, negative-feedback circuits, detectors and oscillators, including LC, RC and relaxation types. Gas-filled valves and their circuits have two chapters and photo-electric cells with their amplifier circuits and light sources have three. The book ends with two chapters on cathode-ray tubes and associated equipment.

The book is essentially non-mathematical in the sense that nothing but elementary algebra is needed. The calculus, as such, is avoided completely, even when dealing with fundamentals. This has needed some ingenuity, for when dealing with such matters as the back e.m.f. across an inductance it is impossible to avoid the idea of a rate of change of current. The author recognizes this, but instead of writing $e = L\,di/dt$ he writes $e = L$ roc i, where " roc " is an abbreviation for rate of change. Many will no doubt object that this means neither more nor less than d/dt, which is perfectly true, but the reviewer has a strong suspicion that there are many readers who will go through the book quite happily with " roc " and understand it, but who would give up at once if they encountered d/dt.

The author is to be congratulated on his use of, and adherence to, the method of expressing relative voltages by the relative height of different points of the circuit in his diagrams. This unquestionably is a very great help in understanding their operation.

In dealing with the principles of superposition in the first chapter the author would have been wise to say that it is valid only with linear circuits. He does say this in a later chapter, but it would prevent any possibility of misunderstanding if the statement were also made here. One minor point is an ambiguity on p. 504, where he states that " the load resistor cannot be made too high "; he means " must not," for the context explains that it is very easily possible to make the load resistor too high. Each chapter concludes with a number of problems, suggestions for additional reading and references.

It would be a pity if the title were to suggest that the interest of the book is confined to industrial electronics. The explanations of fundamentals and valves are so good that those mainly interested in radio would do well to study it. It is a good elementary textbook on the simpler valve circuits which not only explains clearly how they operate, but also gives simple methods of calculating the component values required.—W. T. C.

British Catalogue of Plastics. Editor: E. Molloy. Pp. 704; figs. and charts. National Trade Press, Ltd., Drury House, Russell Street, Drury Lane, London, W.C.2. Price 50s.

This guide to selection, processing and uses is encyclopædic in character and dimensions. It is profusely illustrated in half-tones and colours; properties of plastics, plasticizers, solvents, adhesives and paints are tabulated on five loose wall charts while choice for specific purposes is aided by a special folding plate arranged for easy comparison.

Specialist articles by thirty-five contributors are followed by makers' recommendations on moulding, fabricating and finishing. A considerable portion of the editorial space is given to descriptions of moulds, presses, machinery and auxiliary equipment. A too-brief reference to uses in the electrical industry is mainly illustrative, while nine pages are devoted to the radio industry. The moulding section includes five pages on high-frequency heating and " welding " with eight pages on h.f. equipment of eight different makes. A glossary of terms, list of trade names, directory of manufacturers and an index complete the volume.—W.O.F.

Books Received

Electrical Testing for Practical Engineers. By G. W. Stubbings. (2nd Edition). Pp. 266; figs. 114; index. E. & F. N. Spon, Ltd., 57, Haymarket, London, S.W.1. Price 12s. 6d.

Modern Electrical Engineering Mathematics. By S. Austen Stigant. Pp. 372; figs. 116; index. Hutchinson's Scientific & Technical Publications, 47, Princes Gate, London, S.W.7. Price 31s. 6d.

Cold Snaps and Power Plant

Study of Load-Duration Curves

By "Electricus"

RECENT experience has shown that when the temperature falls below freezing point and remains there for a few days, the demand on the grid goes up by something like one million kilowatts. Only a fraction of this increment is due to electric space-heating installations used regularly, the demand of which may be considered to be directly proportional to the difference between an assumed "basic" and the actual outside temperature. The bulk can be attributed to two purely transient uses of electric fires, namely, for prevention of pipe freezing and for topping-up inadequate solid-fuel installations, especially central-heating systems designed for a temperature rise of the order of 30 deg F.

As there is at present no generating plant available to supply this, however short-time, incremental demand, recourse is had to temporary expedients, such as "load-shedding" and rearrangement of factory working hours, pending the installation of sufficient new plant. It seems, therefore, that every kW of incremental demand made during the, usually, few days of a cold snap is responsible for an additional, say, 1¼ kW (considering system losses and spare capacity) of new plant, costing at present nearly £50*.

In opposition to this argument it has been pointed out that cold-snap peaks are supplied by obsolete, written-off generating plant, which can no longer be used for ordinary operation. It might also be said that "incremental" demand, in the economic sense, was associated with new requirements, not with seasonal increments, and that in assessing the incremental cost related to such truly incremental demand, fluctuations of the price level should be averaged out. However, we are not living under conditions of a free economy, and the approach to the problem in hand must be governed by special considerations, such as housing needs, optimum distribution of man-power between capital-goods and consumer-goods industries, and maximum possible export output. Apart from the question of doubled or trebled cost of new equipment, it seems imperative to keep the manufacture of additional power-station plant for use in this country to the minimum compatible with sound development. A concerted effort should, therefore, be made substantially to reduce cold-snap peaks, and the following discussion deals with the possible effect of such a measure.

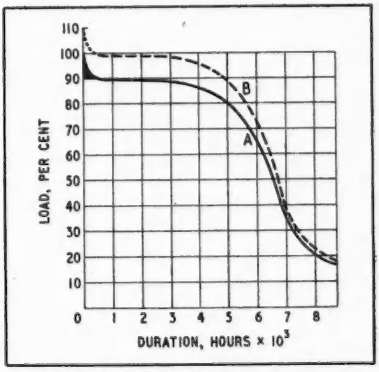


Fig. 1.—Hypothetical load-duration curves

Effect of Lopping Cold-Snap Peaks

Studies of this kind can be based on load-duration curves, obtained by arranging the half-hourly demand values of a system, for a period of a year, in order of magnitude. In Fig. 1, A represents a hypothetical curve, and it is supposed that the top 10 per cent of the load is supplied by obsolete plant, unsuitable for regular use. If we assume that the system load grows by 10 per cent, effective at the same rate all the year round, we obtain curve B. Under the further assumption that the available system capacity was fully utilized in the state A, it will be necessary to install an additional 10 per cent. Now, let us assume that the top 10 per cent of the original load-duration curve is lopped off. Will the existing system be able to cater for a general 10 per cent increase in remaining load, as represented by the portion of curve B below the 100 per cent level.? As the top 10 per cent of plant has

* An exact calculation would also have to take into account transmission and distribution plant, and the capitalized savings in coal consumption obtained by using new generating plant for base-load operation. For the purposes of this article, the above round figure is deemed to be sufficient.

been postulated to be unsuitable for a 3,000 to 4,000 hours' annual operation, the answer is, clearly, "No." In this case, therefore, nothing would be gained by a 10 per cent reduction in annual peak loads, and they could truly be declared to be supplied by "written-off" plant.

However, actual load-duration curves have a different shape. It would be incorrect to take one for the whole grid, for the reason that considerations should be based on regions within which substantial load transfer can take place. No curves for such regions being available, Fig. 2 is based on a single, though large, system in Southern England, and refers to a pre-war year. We, again, make the assumption that the top 10 per cent of the load-duration curve A is cut off and that the remainder is raised by approximately 10 per cent. Obviously, the resulting curve B does not present any fundamental change in conditions, and we are in this case justified in stating that with cold-snap peaks reduced by 10 per cent, the system would be capable of dealing with an overall load increase of about 10 per cent, without requiring additional generating capacity to be installed. Not only is it, therefore, a misconception to

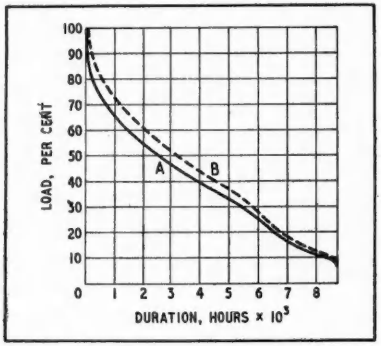


Fig. 2.—Load-duration curves based on actual conditions

think that it always costs nothing to supply cold-snap peaks from written-off plant, but —and this is particularly important at the present juncture—reduction of such peaks would enable substantial reductions to be made in the amount of additional generating capacity now considered necessary.

The use of load-duration curves may be criticized on the ground that peak-load plant is not generally started up and shut down in immediate response to actual load variations. Curve A of Fig. 3 shows for the same system as Fig. 2 the values of daily maximum demand arranged in order of magnitude. Similarly, curve B represents an approximately 10 per

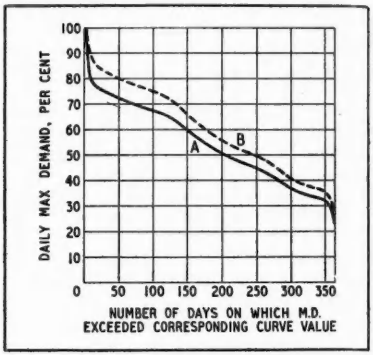


Fig. 3.—Daily maximum demands on the system in Fig. 2 during one year

cent increase, with the top 10 per cent of A assumed to be cut off. It will be seen that, in spite of the increase, 10 per cent of the available generating capacity would have to be put into operation (regardless of hours run each time) on only 10 days of the year, the next 10 per cent on fewer than 50 days, and another 10 per cent on fewer than 140 days. This is a running schedule which, it is supposed, all of the individual grid areas would permit ; but final analyses would, of course, have to be based on the particular load-duration and m.d. distribution curves, and the actual condition of the plant available.

While it appears indisputable that every new kW of space-heating demand added to the cold-snap peaks of coming years will be responsible for an addition of about $1\frac{1}{4}$ kW of generating plant, costing something like £50, it can be asserted that each kW knocked off the already existing potential cold-snap peak demand would at the present juncture result in a corresponding saving of extra plant and capital expenditure, as well as releasing man-power and materials for other urgent home-market requirements and for export. Consideration should also be given to the effect on future electricity charges that huge additions of plant at inflated prices are likely to have. The endeavour to provide new generating plant to meet a steady growth of healthy demand should, therefore, be coupled with an all-out attack on uneconomic cold-snap peak loads.

PERSONAL and SOCIAL

News of Men and Women of the Industry

MORE than two hundred members of the Cromptonian Association (formerly Association of Old Cromptonians) met at the Café Royal, London, for their annual dinner on May 30th. The guests included Lord Brabazon, Sir Robert Renwick, Bt., Sir Charles Bartlett, and Messrs. H. D. MacLaren, G. L. Wates, A. H. L. Gibson, J. G. A. Sutherland, and P. H. Holland.

Dr. P. Dunsheath, C.B.E., director and consulting engineer of W. T. Henley's Telegraph Works Co., Ltd., was recently elected an honorary member of the Engineering Institute of Canada.

The Croydon Corporation Electricity Committee has recommended to the Town Council that the salary of **Mr. F. N. Rendell Baker,** general manager of the Electricity Department, shall be raised from £2,400 to £3,000 per annum.

Mr. W. H. Adcock, B.Sc., M.I.E.E., who is with the General Electric Co. (India), Ltd., has been appointed a member of the Committee set up by the Department of Labour, Government of India, for the training abroad of higher technical personnel for post-war industrial development in India. Mr. Adcock is also a member of the Government of India Pre-Examination Board.

Dr. J. W. T. Walsh has been elected president of the Illuminating Engineering Society for the ensuing session, and the vice-presidents are **Mr. J. M. Waldram, Mr. J. S. Preston** and **Dr. E. C. Walton.** Dr. Walsh is chairman of the National Illumination Committee of Great Britain and is a Principal Scientific Officer in the N.P.L. Light Division. He is known to lighting engineers throughout the world as the author of several works on illumination and photometry. His election sets a new precedent, as this is the first time that any member of the Society has twice been elected to the presidential chair.

Dr. J. W. T. Walsh

Mr. W. Glass, A.M.I.Mech.E., for several years director and general manager of Johnson & Phillips, Ltd., has been appointed joint managing director of the company. **Mr. G. Leslie Wates** is chairman and joint managing director.

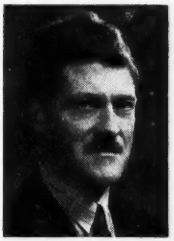
Councillor I. R. Thomas has been elected chairman of the South Wales and Monmouthshire Bulk Supply Association for the year. This association of municipally-owned electricity undertakings comprises more than twenty local authorities in South Wales and Monmouthshire.

Mr. Aubrey H. L. Gibson, governing director of A. H. Gibson (Electrical) Co. Pty., Ltd., and subsidiaries, has arrived in this country on a business visit; he intends to stay until September and hopes to meet firms anxious to export to, or extend their manufacturing interests to, Australia. His companies have headquarters in Melbourne and operate throughout the Commonwealth. Mr. Gibson's address is c/o Commercial Banking Co. of Sydney, 18, Birchin Lane, Lombard Street, London, E.C.3.

Mr. J. T. Lewis, branch manager of Superlamp, Ltd., was elected hon. secretary of the Kent Branch of the Association of Supervising Electrical Engineers at the recent annual meeting of the branch.

Mr. G. W. Molle, B.Sc. (Eng.), A.M.I.E.E., has relinquished his appointment with the Department of Scientific and Industrial Research (Codes of Practice Committee) in order to return to private consulting engineering practice. His address is 9, Collingham Road, Earls Court, London, S.W.5.

In our last issue we reported the appointment of **Mr. C. J. King,** B.Sc.(Eng.), A.M.I.E.E., as E.L.M.A. Lighting Service Bureau area engineer in Scotland, and we now reproduce Mr. King's portrait.



Mr. C. J. King

Lord Ashfield, chairman of the London Passenger Transport Board, and **Mr. Geoffrey Heyworth,** a part-time member of the Board, have been re-appointed for a further period.

Mr. J. Rashleigh Phipps has sailed for South Africa to take up an important post in the industry, and has therefore resigned his position with Rashleigh Phipps & Co., Ltd., of London.

Mr. F. W. Mockett, power station superintendent, Lancaster Corporation, is to retire at the end of the year. He will be succeeded by **Mr. E. H. Scholes,** the present assistant superintendent.

Mr. T. H. Watson, A.M.I.E.E., meter superintendent with the Kettering Corporation Electricity Department, has been appointed meter and test superintendent to the Ipswich Corporation Electricity Department. Mr. Watson takes up his new duties on July 1st.

Ct

He was formerly with Norwich Corporation and Chamberlain & Hookham, Ltd.

Mr. W. Nithsdale, B.Sc., M.I.Mech.E., M.I.N.A., has retired from the board of Richardsons, Westgarth & Co., Ltd., and on May 30th received presentations from the staff. In his farewell remarks Mr. Nithsdale said that Sir Summers Hunter, the managing director, had been freed from Admiralty duties and was again able to supervise the wider interests of the company, and Mr. W. E. Loveridge was now resident director in charge of the Hartlepool works.

Appointments Vacant.—In this issue the Northampton Polytechnic (London) is advertising the position of head of the Electrical Engineering Department at a salary of £1,000 rising to £1,100, plus allowances. The Borough of Fleetwood advertises the vacancy in the post of borough electrical engineer rendered vacant by Mr. W. P. Lilwall's retirement (commencing salary of £846 plus cost-of-living bonus).

The Music and Drama Section of Siemens Sports Club successfully presented the light comedy "Nothing But the Truth" at their club hall on May 16th and 17th. The play was produced by Colin G. Scott, and those taking part were Messrs. R. F. Chapman, R. F. Luff, D. G. Skinner, C. W. Nearn, W. D. Cornwell, G. Millard, Margaret Coffey, Marjorie Killick, Irene Loveless, Irene Hayes, and Doreen Kenchington. The stage manager was Mr. W. Womack with Nancy Cockburn as his assistant. Amongst the audience were Mr. S. W. Lumb, secretary of the company, Mr. Baker, labour manager, Mr. Shaw (chairman of the Sports Club) and Mrs. Shaw,

Obituary

Mr. E. S. Conradi.—We regret to record the death, which occurred on May 27th, of Mr. Emil S. Conradi, chairman and managing director of the British Central Electrical Co., Ltd. Mr. Conradi commenced his electrical training at the City and Guilds Technical College, London, in 1897, whence he proceeded to the Finsbury Technical College, where he worked under Professor Silvanus Thompson and gained a mechanical engineering diploma. In 1899 he went to the power station of the Electric Light Department at the London General Post Office, and from there in 1900 to the British Thomson-Houston Co., Ltd., Rugby, for five years. He then proceeded to Bruce Peebles & Co., Ltd., Edinburgh, where he was engineer-in-charge of the Falkirk District Tramways contract and later chief engineer of the outside erection department. In 1908 he founded the British Central Electrical Co., Ltd. He was the inventor of the "Gripper" handlamp and numerous other patents. Mr. Conradi will be well remembered for his work for the E.I.B.A., for which he personally collected over £2,000. He leaves a widow and two sons.

The late Mr. E. S. Conradi

Mr. R. F. Winder.—We regret to learn of the death of Mr. Rowland Frederick Winder, governing director of R. F. Winder, Ltd., Leeds, which occurred on May 26th at the age of seventy-two. His connection with the electrical industry was life-long, beginning with his apprenticeship to Manson Mercier, Manchester. Later he became manager for Norman Hirst, Ltd., Leeds, and commenced business on his own account as an electrical contractor in Leeds nearly fifty years ago. He added a surplus plant department to his business and one of his earliest purchases was the motor that drove the Big Wheel at one of the Edwardian exhibitions. The business is being carried on by his eldest son with the co-operation of a directorate of those who helped to build up the business.

Mr. W. Matthews.—The death occurred suddenly on May 25th of Mr. William Matthews, Associate I.E.E., mains superintendent of the Tunbridge Wells Corporation Electricity Department. Mr. Matthews, who was born in 1892, was educated at Newport (Mon.) High School and Newport Technical College, and was an articled pupil to the borough electrical engineer at Newport from 1909 to 1912, becoming a junior engineer with the Newport Electricity Department. In 1913 he was promoted to charge engineer with that undertaking and two years later joined the Midland Electric Power Co., Ltd., at Tipton, Staffs, as district mains superintendent. He was appointed mains superintendent at Tunbridge Wells in 1926.

Batti-Wallahs' Society

THE importance of the agricultural industry to the industrial and social welfare of the country was the theme of an interesting address given at last week's luncheon of the Batti-Wallahs' Society, by Mr. E. H. Gardener, vice-president of the National Farmers' Union, who quoted figures showing that the agricultural industry was still the major industry of the country. In addition to providing the greater part of the country's needs of food it was also an important buyer of a variety of goods, including machinery and appliances for the home. It was one of the few industries which had expanded in recent years and it would be able to produce a great deal more if it could only obtain the necessary equipment. During the luncheon Col. H. J. Wellingham, the president, invested Mr. P. V. Hunter, the immediate past-president, with the past-presidents' badge.

Joint Authorities' Meeting

Guests of the Ayrshire Electricity Board

THE summer meeting of the Conference of Joint Electricity Authorities and Joint Boards was held on May 29th at Troon, by invitation of the Ayrshire Electricity Board, and was followed by an inspection on the following day of part of the Board's undertaking. Delegates were present from most of the joint electricity authorities and joint boards, those from London, with Mr. Norman Elliott, O.B.E., and Mr. A. L. Burnell (honorary secretary and assistant honorary secretary of the Conference) and Mr. H. F. Carpenter (West Midlands J.E.A.) undertaking the journey by the regular service of the British European Airways Corporation.

The Conference decided to urge upon the Government the urgent necessity of a country-wide adoption of plans for minimizing load shedding during the coming winter and expressed concern at the slow response of industrial consumers to the appeal for staggering of load and hours. In this connection, particular attention was directed to the difficulty of negotiating appropriate wage rates for altered hours of work and the Government is to be asked to issue recommendations immediately.

Provost T. Murray, J.P., chairman of the Ayrshire Electricity Board, presided when the Board entertained its guests at dinner. References were made by several speakers to the impending nationalization of the industry. Mr. Henry Nimmo (Electricity Commissioner) in proposing the toast of "The Conference," spoke of the team spirit which had generally characterized the work of joint authorities and joint boards—a spirit which had been exemplified by the Conference—and County Alderman A. Hewitt (chairman of the Conference) said that, in looking back, members could claim their task in serving the industry to have been well done.

Mr. C. Heathcock (chairman, West Midlands J.E.A.) paid tribute to the hospitality of the Ayrshire Board and to the work it had done for consumers in its area. He wondered about the future of the industry but hoped that the skill and talent which had done so much for its advancement would be transplanted to the new environment, a hope which the president of the Incorporated Municipal Electrical Association (Mr. J. S. Pickles) reinforced, expressing the view that nationalization of the industry should, perhaps, be regarded as its reincarnation. Technical progress, he said, had admittedly outstripped the administrative machine and the cobwebs could with advantage be brushed away. The people who had created and developed the electricity supply industry would still, he hoped, be associated with it and upon their spirit of enterprise and initiative would depend the future success of the re-organized industry.

"Our Guests" was proposed by Mr. W. C. Bexon and Mr. William Ross, M.P. for Kilmarnock, and Alderman W. S. Lewis (vice-chairman, West Midlands J.E.A.) responded.

Scottish Water Power

Plant Manufacture on the Clyde

A BLASTING charge fired on May 30th by Mrs. Thomas Johnston, wife of the chairman of the North of Scotland Hydro-Electric Board, marked the start of work on the Board's Mullardoch–Fasnakyle–Affric hydro-electric scheme in Strathglass, Inverness-shire. The excavation of the generating station site was commenced immediately afterwards.

The scheme will utilize the water-power resources of the Glen Affric and Glen Cannich area to produce about 250 million kWh annually. In addition to supplying the needs of local consumers the scheme will provide for industrial development in the north-east of Scotland. It will cost about £4,800,000 and take about three years to complete.

Mr. A. W. MacColl, vice-chairman of the Hydro-Electric Board, who presided at the inauguration ceremony, said that from the outset the Board decided that it was desirable, and an endeavour should be made to create a new industry in Scotland for the specialist type of mechanical plant required by the Board, and it approached the English Electric Co., Ltd. Sir George Nelson, chairman of the company, had notified him that the company was proposing to manufacture those machines on the Clyde. Negotiations had been completed for the subcontracting of work on hydro-electric generating plant in part of Harland & Wolff's shipyard at Scotstoun. The work to be undertaken on the Clyde would include not only the machines for the large contracts the Board had placed and would place, but export business in hydro-electric machinery, which was very substantial. The export business would be dealt with largely from the Clyde works.

Mr. Johnston, who also spoke, said the Board had 102 schemes in view, which would produce about 6,000 million kWh per annum.

The Board has sent us a copy of a brochure distributed to members of the Institution of Electrical Engineers who visited the Board's Tummel-Garry Scheme at Pitlochry on May 24th. This contains brief particulars of the various hydro-electric projects which the Board has in hand, with maps and illustrations of some of the dams and generating stations.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Earthing Conductors

IN reply to "Pro Bono Publico" in your issue of May 23rd, previous to my engagement erecting some d.c. motors, several accidents were caused by earth wires becoming disconnected, owing to the motors earthing as a result of neglected maintenance.

I decided to install triple-pole switches, using the third contact for the v.i.r. earth wire, which passed through the conduit and was connected to the motor terminal box. The small extra expense was considered to be justified by increased safety.

London, E.7. HENRY BROWNE.

IT is difficult in my opinion to find any justification for the practice of running the earth wire external to the flexible conduit except possibly that the wireman wanted to show that he *had* run an earth continuity conductor and not left the earthing of the apparatus to the flexible conduit itself, as so often, unfortunately is the case!

Par, Cornwall. J. S. BACON.

Cost of Living Index

WE power engineers are all labouring to-day under exactly similar circumstances to those of "C.O.L. Index Victim." The burdens placed upon us by the war have been enormous. They have been willingly borne with no suggestion of "go slow," strikes or other restrictive practices, which is perhaps a pity as this seems to be the only method of getting anything these days. Loyal and unstinted service is not appreciated. "You get the 'Schedule,' so what are you grumbling about?"

We are expected to hold degrees and to be members of one or more of the leading institutions, but I for one will soon be compelled to give all these up as I cannot afford it any longer. In fact, I can no longer afford a holiday.

How on earth staff is to be maintained for the vast programme of expansion I do not know. Only mugs will enter such an underpaid profession. It seems utterly unreasonable that so prosperous, efficient and progressive an industry as this can only reward its technical staffs by little more than a mere pittance. As an example, a power station superintendent of a Class J plant, 100,000 to 150,000 kW, considered to be a "plum" job, can rise no higher than £821 per annum (£758 in 1939). If he ran a Class O plant, over 450,000 kW, he could look forward to £1,095 per annum. I quote this as it is finality in the N.J.B. Schedule. He is on duty 24 hours a day, usually required to live near his work, and unable to go away without permission. The plant he runs may be worth several million pounds. Its turnover, expressed mainly in terms of fuel consumed, may amount to £20,000 a week. A gain or loss of 0·5 per cent of this sum would never be seen, yet it represents a matter of about £100 a week. A man not "on his toes" would let far more than 0·5 per cent slip past him. Yet this man is worth a wage equal to little more than that drawn by three labourers. If he were paid twice his present scale he would not be overpaid. The whole thing is scandalous and disgraceful, a blot on an industry whose record is otherwise unimpeachable.

The present salary structure will, I submit, attract only third-rate men. A first-class industry cannot afford to run on the cheap, and must employ first-class men.

ANOTHER VICTIM.

Engineering Calculations

ALTHOUGH Mr. Perrin's explanation of the difference between weight and mass is excellent, how would it be affected by using a space unit other than the foot, say cm, inches or yards, or "gravits" for that matter? In cm g is equal to 981, in feet g = 32·2, in gravits g = 1. Which is the simplest? "Why, Sir," as Dr. Johnson would have said, "must we continue an unnecessary obfuscation?"

Mr. Rottenburg's letter is very interesting, and worth a little study. I feel he could usefully enlarge on some of his observations, particularly the difference between "mass" and "inertia." His suggestion of substituting the "graviner" for the slug or engineer's unit is, I think, an excellent one. It has the advantage of scientific precision, and avoids all that nonsense about dividing a "weight" by g and obtaining a "mass."

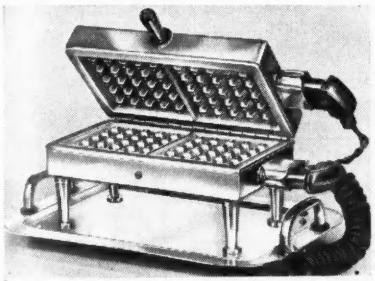
East Ham. D. G. SANDEMAN

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Waffle Iron

A NEW waffle iron has been introduced by the COOPER MANUFACTURING CO., Hanway Works, Hanway Street, London, W.1. Constructed in aluminium throughout with polished or anodized finishes, this "Lexington De Luxe" appliance has a pleasing appearance and is provided with a grease tray with rubber feet. The two side-entry shrouded input sockets with earthing clips are mounted in mica supports to prevent breakdown through heat. No current is carried through the full-length piano-type hinge to



"Lexington De Luxe" waffle iron

which the platens are attached. The 900-W nickel-chrome elements are of the standard domestic smoothing-iron type and together with the platens are easily removable for servicing. Two waffles can be cooked simultaneously in 1½–2 minutes.

Welding Electrodes

The choice of electrodes for arc welding pressure vessels has hitherto been very limited. What is claimed to be the first all-British type specifically designed for this purpose is announced by MUREX WELDING PROCESSES, LTD., Waltham Cross, Herts. The type "PV" is specially devised for ease of running in the downhand position in deep groove multi-run welds. It is suitable for both a.c. at 80 to 100 V and d.c. at 60 V, the latter being recommended for superior results. This electrode is available in various gauges to suit all plate thicknesses and may also be advantageously used for work which is to be vitreous enamelled, or for vacuum-tight equipment.

Checking A.F. Response

Apparatus for automatically checking the audio-frequency response of telecommunication networks has been introduced by REDIFFUSION, LTD., Broomhill Road, Wandsworth, London, S.W.18. The outfit avoids the need for a pilot line for "ganging" between the points of input and output however far apart they may be. Checking can be done very quickly during line-pause intervals, without interrupting transmission over the line being tested. The operator is able to initiate and record testing signals entirely from his (receiving) end of the line without synchronized assistance from the distant (sending) end of the line. The result is presented directly on the calibrated screen of a cathode-ray tube, which has a long after-glow, so that the total response is superimposed on the oscillograph grid in a manner similar to a graph plotted on squared paper. The overall power consumption of the outfit is of the order of 330 W, which may be derived from a.c. mains, or through a rotary convertor driven by 12-V car-type batteries. The outfit may also be used for rapidly checking the response of amplifiers, filters, coupling networks and kindred apparatus.

Dual-purpose Handlamp

A dual-purpose hand lamp, which somewhat resembles those used by miners underground and has been used for emergency lighting in naval ships, is made by OLDHAM & SON, LTD., Denton, Manchester. It is normally operated from the mains, but it contains an accumulator and a hold-off relay in the base of the container. Failure of the mains supply interrupts the 6 mA passing through the relay, so relaxing its armature, which closes the lamp-accumulator circuit. The reverse action occurs automatically when the mains supply is restored. Separate wiring is not necessary, since the lamps can be looped into the nearest convenient circuit and they may be fixed in a bulkhead bracket or spring-clip suspended overhead, for speedy removal for use as portable lamps. Standard d.c. and a.c./d.c. models are available.

South African News

THE Council for Scientific and Industrial Research, in a report to Parliament, says that its telecommunications laboratory has made considerable progress in the design, development and construction of automatic equipment for the sounding of the ionosphere and is operating two such equipments continuously, one in Johannesburg and the other at Slangkop, near Cape Town.

FOOD STORAGE IN TUGS.—A portable electric refrigerator, specially built in the railway workshops for use in Table Bay tugs when they go to sea, has undergone tests. In the past it has been found that there is little opportunity for keeping food fresh in the tugs when they are at sea for more than three days at a time, and the electric refrigerator has been built for issue to any of the tugs going on a deep-sea trip.

Standard Rural Lines

Sag-Tension Charts for Solid Copper Conductors

By *John McCombe*, Ph.D., A.R.T.C., M.I.E.E.

THE new B.S. 1320 for high-voltage overhead lines on wood poles for line voltages up to and including 11 kV with conductors not exceeding 0·05 sq in. was summarized in the *Electrical Review* of August 23rd, 1946. This recommends stranded hard-drawn copper conductors in two sizes, namely, 0·025 sq in. (3/·104 in. diam.) and 0·05 sq in. (3/·147 in. diam.). Many engineers like myself prefer solid conductors in the smaller sizes and may find of assistance the following calculations of sag-tension charts for 0·0243 sq in. (No. 7 s.w.g.) and 0·05 sq in. (No. 3 s.w.g.).

Sag-tension chart for 0·05 *sq in. conductors based on a* 350-*ft equivalent span* :—Conductor diameter, 0·252 in.; ice coating, nil; weight of conductor (W), 0·19223 lb per ft run; breaking load of conductor, 2,875 lb; factor of safety, 2·5; maximum working load, $\frac{2,875}{2·5}$ = 1,150 lb; modulus of elasticity (E), 18×10^6 lb per sq in.; coefficient of linear expansion (α), $9·22 \times 10^{-6}$ per deg F.

The breaking stress of the conductor will then be $\frac{2,875}{0·05}$ = 57,500 lb per sq in.; and the maximum working stress (f_1) will be $\frac{1,150}{0·05}$ = 23,000 lb per sq in. The weight of conductor

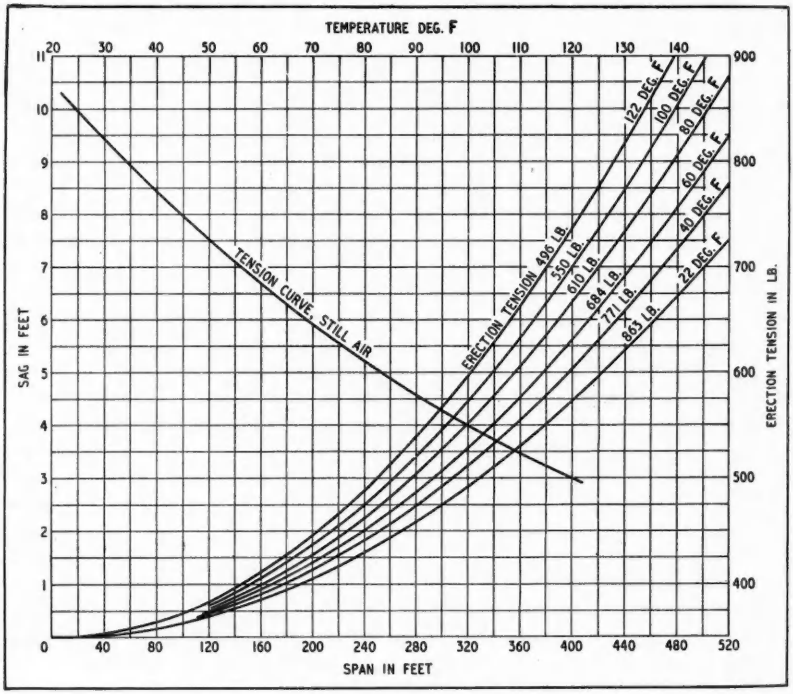


Fig. 1.—Erection sag curve for 0·05 in. (No. 3 s.w.g.) solid copper conductor. Factor of safety 2·5 with 16 lb per sq ft windage and no ice. Maximum working tension 1,150 lb. Constant erection-tension in all spans at erection temperature. Basic span 350 ft.

per ft run per sq in. (δ) is $\frac{1}{0{\cdot}05} \times 0{\cdot}19223 =$ 3·845 lb, and the windage per ft run on conductor at 16 lb per sq ft (P) is $\frac{0{\cdot}252 \times 12 \times 16}{144} =$ 0·366 lb, so that the loading factor, wind and weight (q_1) = $\frac{\sqrt{P^2 + W^2}}{W} = \frac{\sqrt{0{\cdot}336^2 + 0{\cdot}19223^2}}{0{\cdot}19223} = 2.$

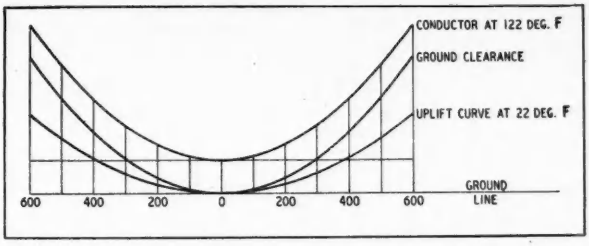


Fig. 2.—Catenary template 0·05 sq in. (No. 3 s.w.g.) copper conductor. Maximum working tension 1,150 lb. Factor of safety 2·5

Loading factor in still air, $q_2 = 1$; sag at worst load conditions at 22 deg F = $\frac{l^2 \delta q_1}{8 \times f_1} =$ $\frac{350^2 \times 3{\cdot}845 \times 2}{8 \times 23{,}000} = 5{\cdot}12$ ft; tension at worst load conditions at 22 deg F = 1,150 lb.

Sag and tension at 122 deg F.—Let f_2 = stress in lb per sq in. in the conductor at still air temperature t deg F, then

$$f_2^2[f_2 - (K - \alpha tE)] = \frac{l^2 \delta^2 q_2^2 E}{24}$$

$$K = f_1 - \frac{l^2 \delta^2 q_1^2 E}{24 f_1^2} =$$

$$23{,}000 - \frac{350^2 \times 3{\cdot}845^2 \times 2^2 \times 18 \times 10^6}{24 \times 23{,}000^2} =$$

$$23{,}000 - 10{,}270 = 12{,}730.$$

$$\frac{l^2 \delta^2 q_2^2 E}{24} = \frac{350^2 \times 3{\cdot}845^2 \times 1 \times 18 \times 10^6}{24} =$$

$1{\cdot}358282 \times 10^{12}$.

$t = (122 - 22)$ deg F = 100 deg F; $\alpha tE = 9{\cdot}22 \times 10^{-6} \times 100 \times 18 \times 10^6 = 16{,}596$.

$$f_2^2[f_2 - (K - \alpha tE)] = \frac{l^2 \delta^2 q_2^2 E}{24};$$

$f_2^2[f_2 - (12{,}730 - 16{,}596)] = 1{\cdot}358282 \times 10^{12}$; $f_2^2[f_2 + 3{,}866] = 1{\cdot}358282 \times 10^{12}$; $f_2 = 9{,}930$ lb per sq in.

TABLE 1

Equivalent Span 350 ft		
Temperature, deg F	Sag, ft	Tension, lb
22 Loaded	5·12	1150
22 Still Air	3·41	863
40 " "	3·89	771
60 " "	4·30	684
80 " "	4·82	610
100 " "	5·35	550
122 " "	5·92	496

TABLE 2

22 deg F		40 deg F		60 deg F	
Span, ft	Sag, ft	Span, ft	Sag, ft	Span, ft	Sag, ft
100	0·28	100	0·32	100	0·35
200	1·11	200	1·27	200	1·40
300	2·51	300	2·86	300	3·16
350	3·41	350	3·89	350	4·30
400	4·45	400	5·08	400	5·62
500	6·96	500	7·94	500	8·78
Constant erection-tension = 863 lb		Constant erection-tension = 771 lb		Constant erection-tension = 684 lb	
80 deg F		100 deg F		122 deg F	
100	0·39	100	0·44	100	0·48
200	1·57	200	1·75	200	1·93
300	3·54	300	3·93	300	4·35
350	4·82	350	5·35	350	5·92
400	6·30	400	6·99	400	7·73
500	9·84	500	10·92	500	12·08
Constant erection-tension = 610 lb		Constant erection-tension = 550 lb		Constant erection-tension = 496 lb	

TABLE 3

Temperature, deg F	Sag, ft	Tension, lb
22 Loaded ..	3·35	591
22 Still Air ..	1·69	434
40 " " ..	1·94	379
60 " " ..	2·26	324
80 " " ..	2·64	278
100 " " ..	3·05	240
122 " " ..	3·51	209

TABLE 4

22 deg F		40 deg F		60 deg F	
Span, ft	Sag, ft	Span, ft	Sag, ft	Span, ft	Sag, ft
100	0·27	100	0·31	100	0·36
200	1·08	200	1·24	200	1·45
250	1·69	250	1·94	250	2·26
300	2·43	300	2·79	300	3·25
350	3·31	350	3·80	350	4·43
Constant erection-tension = 434 lb		Constant erection-tension = 379 lb		Constant erection-tension = 324 lb	
80 deg F		100 deg F		122 deg F	
100	0·42	100	0·49	100	0·56
200	1·69	200	1·95	200	2·25
250	2·64	250	3·05	250	3·51
300	3·80	300	4·39	300	5·05
350	5·17	350	5·96	350	6·88
Constant erection-tension = 278 lb		Constant erection-tension = 240 lb		Constant erection-tension = 209 lb	

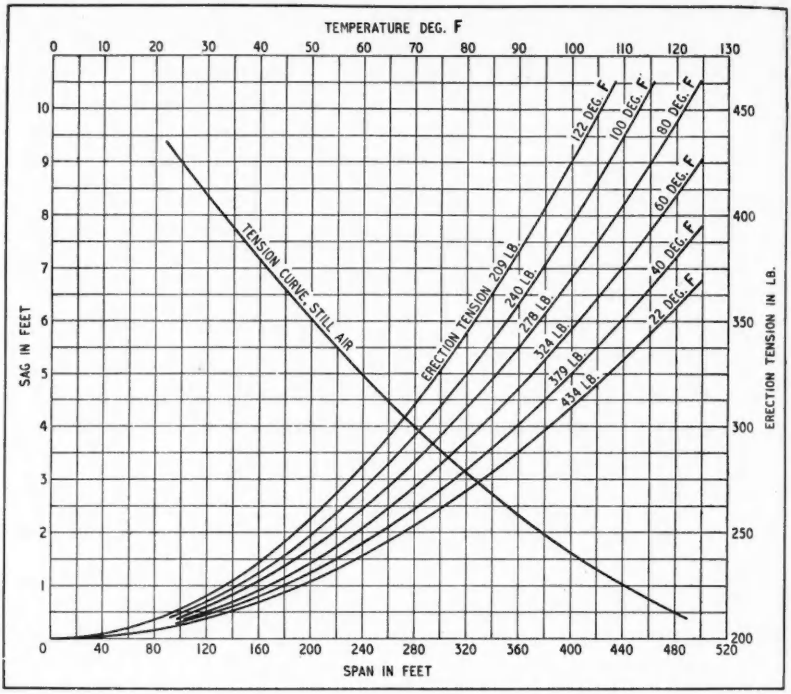


Fig. 3.—Erection sag curve for 0·0243 in. (No. 7 s.w.g.) solid copper conductor. Factor of safety 2·5. Maximum working tension 591 lb. Constant erection-tension in all spans at erection temperature. Basic span 250 ft

Tension = stress × area = 9,930 × 0·05 = 496 lb; sag $= \frac{l^2\delta q_2}{8 \times f_2} = \frac{350^2 \times 3{\cdot}845 \times 1}{8 \times 9{,}930} = 5{\cdot}92$ ft.

Sag and tension at 22 deg F.—

$t = (22 - 22)$ deg F $= 0$ and $\alpha tE = 9{\cdot}22 \times 10^{-6} \times 0 \times 18 \times 10^6 = 0$.

$f_2^2[f_2 - (K - \alpha tE)] = \frac{l^2\delta^2 q_2^2 E}{24}$;

$f_2^2[f_2 - (12{,}730 - 0)] = 1{\cdot}358282 \times 10^{12}$;

$f_2^2[f_2 - 12{,}730] = 1{\cdot}358282 \times 10^{12}$; $f_2 =$ 17,270 lb per sq in.

Tension = stress × area = 17,270 × 0·05 = 863 lb; sag $= \frac{l^2\delta q_2}{8 f_2} = \frac{350^2 \times 3{\cdot}845 \times 1}{8 \times 17{,}270} = 3{\cdot}41$ ft.

The sags and tensions at other temperatures (Table 1) are calculated in the same way.

The sags for the other spans can be determined in the following way:—

Sag on span x $= \frac{\text{basic sag}}{\text{basic span}^2} \times \text{span } x^2$.

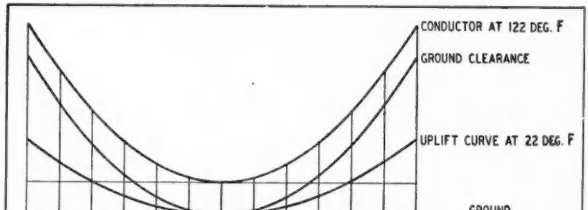


Fig. 4.—Catenary template 0·0243 sq in. (No. 7 s.w.g.) copper conductor. Maximum working tension 591 lb. Factor of safety 2·5

As an example, to determine the sag on a 400 ft span at 60 deg F, sag on 400 ft span = $\frac{4 \cdot 3}{350^2} \times 400^2 = 5 \cdot 62$ ft.

The sags for various span lengths and temperatures and the sag-tension chart (Fig. 1) for field-erection purposes can be plotted from Table 2. Fig. 2 is the corresponding catenary template for fixing the pole heights. For 0·0243 copper conductors, sags and tensions for an equivalent span of 250 ft are given in Table 3.

Table 4 gives the sags and tensions for the various span lengths at the temperatures specified and from these the sag-tension chart is plotted as in Fig. 3, while Fig. 4 shows the corresponding catenary template for fixing the pole heights.

Royal Society Soirée

Ingenious Electrical Demonstrations

ALTHOUGH not so numerous as they used to be, the experimental equipment and demonstrational apparatus exhibited at the first post-war conversazione of the Royal Society on May 29th under the presidency of Sir Robert Robinson, included several items of electrical interest. For instance Mr. A. C. Downing's remarkable galvanometer, because of the minute adjustments of the balance of its moving coil, can be used under conditions of mechanical disturbance (for example, on board ship) which would exclude any ordinary instrument of comparable sensitivity. The suspended coil weighs 15 mg, and has a resistance of 50 ohms, a period of from one-fifth to one-eighth second, and a sensitivity of 3×10^{-7} V which means a scale spot movement of 1 mm at one metre distance.

Mr. N. V. Attree and Professor A. V. Hill showed how to magnify the deflections of a galvanometer of 5 to 10 milliseconds period, by coupling it through a twin photo-cell and amplifiers to a cathode-ray tube; high sensitivity was obtained with a very rapid deflection.

Dr. K. Mendelssohn's fluxmeter was developed at the Clarendon Laboratory, Oxford, for directly measuring radiant heat in medical treatment, but it should be applicable to industrial purposes. High sensitivity is not essential in medical use, the important need being ability to respond to all frequencies from the visible to the far infra-red (about 8 μ) of the spectrum emitted. The "pick-up," assembled in the form of a hand microphone, simply consists of two thermo-couples attached to blackened discs, one of which is exposed to the source of heat radiation while the other receives "black body" radiation from the room temperature.

The design is such as to equalise the air temperature at both discs; in consequence, the indicated thermo-e.m.f. is a measure of the difference between the amounts of radiation energy impinging upon the discs. The indicating instrument's needle remains quite steady, even when cold air from a blower is directed at right angles to the radiant beam between pick-up and source of heat.

Poor colour rendering and delay in furnishing full light output immediately after switching on have hitherto prevented mercury-vapour discharge lamps from being used in place of carbon arcs for lighting cinema studios. Both these disadvantages have been overcome by the British Thomson-Houston Co., Ltd., which offers the modified lamps in sizes up to 10 kW each, silent, enclosed and prefocused. For colour comparison, a Technicolor film photographed with carbon arcs and mercury-cadmium lamps was exhibited at intervals during the evening. The instantaneous re-ignition of the hot high pressure m.v. lamp was also demonstrated, together with the employment of a magnetic field to control the position of the arc when the lamp is tilted.

The research laboratories of the General Electric Co., Ltd., demonstrated simple conversion of electro-magnetic to acoustic energy. Energy of 12·5 mm wavelength was generated by a magnetron in short pulses at a high frequency of repetition, its mean value being varied at an audio-frequency. The energy was focused on to a glass bulb filled with ammonia and closed by a rubber diaphragm. The absorption of energy of that wave-length by the ammonia gas appeared as increased translational energy, the resulting pressure fluctuations causing the emission of an audible note from the diaphragm. Comparison with a similar vessel filled with air indicated the marked difference between the absorption coefficients of the two gases.

Certain ferro-electric insulating materials have dielectric properties closely analogous to the magnetic properties of ferromagnetic substances. The relation between polarization and electric fields of the former are of the form of a hysteresis loop at temperatures below their Curie points. Such loops for potassium dihydrogen phosphate (Curie point minus 150 deg C) and for barium titanate (Curie point plus 120 deg C) were exhibited on the screen of a cathode-ray oscillograph by Mr. J. K. Hulm (Cavendish Laboratory, Cambridge) who demonstrated the disappearance of the ferro-electric properties when the temperature was raised above the Curie point.

Mr. J. M. M. Pinkerton demonstrated apparatus devised on radar principles for

measuring both the velocity and absorption of ultrasonic waves (at various frequencies between 7·5 and 67·5 Mc/s) in liquids contained in a trough, the temperature of which could be thermostatically be maintained at any desired degree.

Messrs. M. Ryle and D. D. Vonberg (Cavendish Laboratory, Cambridge) exhibited diagram records to indicate the methods employed for measuring the intensity of radiation from the sun at radio frequencies (175 and 80 mc/s) and of continuously recording it separately from the radiation which originates in the galaxy. An extension of the method enables the size of the active source region (July, 1946, sun spots) to be measured.

The National Physical Laboratory (Radio Division) showed how the dielectric characteristics of water, or other fluids, at centimetre wavelengths can be measured by directing a narrow beam of electro-magnetic radiation at nearly normal incidence on to the surface of a thin " sheet " of the fluid. A sharply directive receiver can be employed to determine the relative intensity of the beam reflected from the surface. Alternatively, by placing the receiver underneath the glass surface on which the " sheet " of fluid rests, it can measure directly the intensity of the transmitted beam. From these observations the dielectric properties of the liquid " sheet " can be calculated.

The N.P.L. (Metallurgy Division) indicated the variations of expansion of a rod of pure uranium when taken through a series of heating and cooling cycles as well as the preferred orientation produced by warm rolling.

The Science Museum demonstrated a mechanical model illustrating the uranium chain reaction and an optical model depicting the principle of the Bragg X-ray spectrometer, while the Davy-Faraday Research Laboratory of the Royal Institution exhibited early demonstration apparatus for electron diffraction, its source of constant high voltage being a single-plate electrostatic machine.

Power Engineers' Conditions

Claims by E.P.E.A.

FOR some time past the National Executive Council of the Electrical Power Engineers' Association has been considering proposals for the revision of the national agreement on salaries and conditions. These proposals would involve a complete reconstruction of the agreement which would take some time. In the meantime there are certain urgent matters which the Executive Council thinks should be dealt with at once by the National Joint Board of Employers and Members of Staff (Electricity Supply Industry).

The first of these is stand-by duties which, it is stated, have become progressively more onerous and bear heavily upon many members. It is to be proposed to the N.J.B. that stand-by duties shall be defined; the frequency of such duties and the maximum time to be put in shall be dealt with; and the question of extra payment settled.

Hours of duty is another subject for discussion. A thirty-eight hour week is claimed for shift workers and the case of members not on shift work whose hours are longer than the normal office hours is put forward.

With regard to classification, it is proposed that continuous maximum rating of the station shall be substituted for the present system. The main provisions in a claim relating to holidays are that entitlement to leave is based on continuous service in the supply industry; that, with the usual restrictive provisions, six months' service gives a title to fourteen consecutive days, twelve months' service not less than twenty-one consecutive days, with one day added for each year of service up to a maximum of twenty-eight days. The clause dealing with bank and statutory holidays is to be amended to eliminate the known anomalies.

Mechanical Engineering Research

A NEW organization of the Department of Scientific and Industrial Research is being set up to carry out fundamental research in mechanical engineering. Its main purpose is to supplement the work of other research bodies and to fill in gaps in existing systems.

Seven main subjects for research are envisaged:—Properties and strength of materials: solids, stress, stability and vibration of structures; fluids, aerodynamics, gas dynamics and hydraulics; lubrication, wear and corrosion; mechanisms, engineering metrology and noise control; deformation and machine-shaping of materials; heat transfer, heat exchange apparatus and applied thermodynamics.

Dr. G. A. Hankins, Superintendent of the Engineering Division of the National Physical Laboratory, has been appointed Director of Mechanical Engineering Research. He will be advised by a board of scientists and engineers (the members of which will serve in an honorary capacity) presided over by Dr. H. L. Guy and including Mr. D. B. Hoseason (Brush Co.) and Sir Claude Gibb (C. A. Parsons & Co.) with electrical affiliations.

Pending the building of the research station on land yet to be acquired, much of the work will be carried out at the N.P.L. and at universities. Annual expenditure will eventually be from £250,000 to £350,000. There are about 60,000 mechanical engineers in this country (twice the number of electrical engineers and four times that of civil engineers) who are eligible for the technical and scientific register of the Ministry of Labour, which allocates them among 98 separate activities, compared with 57 in electrical and 21 in civil engineering

COMMERCE and INDUSTRY

Reports on Boiler Deposits. Bury Jubilee Exhibition.

AS a sequence to its Bulletins dealing with deposits on the external heating surfaces of water-tube boilers, the Boiler Availability Committee is to issue a series of specialized reports. Technical Paper No. 1 (MC/161) by Dr. H. E. Crossley comes from the Fuel Research Organization of the Department of Scientific and Industrial Research, which seeks to establish the effects of various constituents and kinds of coals and to make constructive suggestions. The information has been obtained from a large number of engineers during visits to thirty-six British power stations.

The Paper (of 23 pages) is in thirteen sections, as follows: Severity of deposit troubles; boiler design; boiler rating; immunity; boiler control; arbitrary outage; sootblowing; banking; tube spacing; fuel and combustion; high-temperature deposits; economizer deposits; air-heater deposits. Regarding the first item, it is stated that stoker-fired boilers commonly run from 1,000 to 2,000 hours and pulverized-fuel units from 4,000 to 9,000 hours between cleanings.

Luton District Heating Scheme

For a new town which it is building for 7,000 to 8,000 people Luton Town Council is preparing a district heating scheme, estimated to cost £322,000, for submission to the Ministry of Health. The cost to tenants would, it is thought, be about 8s. 6d. a week, covering the heating of all rooms and the provision of unlimited hot water supplies.

Ruislip Electrical Exhibition

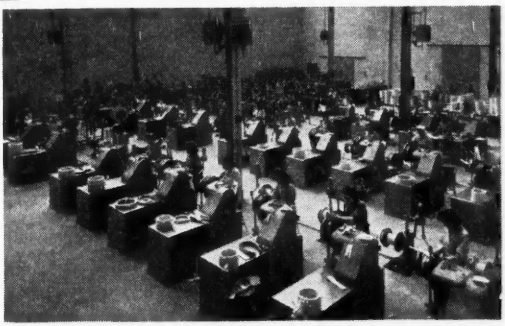
On the occasion of the Summer Flower Show, the Northwood Electric Light & Power Co., in conjunction with the Ruislip and District Horticultural Society, is arranging an exhibition of electrical and domestic appliances at Field End Farm, West End Road, Ruislip, on Saturday, June 28th.

Export Licensing Control

Changes in export licensing control are made by a new Board of Trade Order which comes into operation on June 9th. Among the goods which will not require export licences as from that date are sulphur, mica, well-drilling machinery and a number of chemicals. Supply considerations have rendered it necessary, however, to impose export licensing control on cast iron ingot moulds, electro-cardiographs, lead acid accumulators of all types and their parts, and certain drugs.

Bruce Peebles Extensions

To cope with the rising demands for their products Bruce Peebles & Co., Ltd., have made a large-scale extension to their transformer shop at East Pilton Works by the addition of a new coil winding department which is among the largest and most extensively equipped in the country. The first impression of this large new department is of a lofty, light, and airy building, with neat rows of pleasingly coloured, quiet running machines, arranged according to their place in production with a most effective use of area, and clear gangways. The lighting and heating arrangements are admirable, and there is ample individual working space. The new department, now in full operation, is playing an important part in the production of a wide variety of coils for the many transformers which the company is supplying for various hydro-electric schemes of the North of Scotland Hydro-Electric Board, for the national electric grid, for the National Coal Board for use in mines all over the country, and for large numbers of concerns both at home and abroad.



New coil-winding department at the East Pilton works of Bruce Peebles & Co., Ltd.

Private Trade with Japan

The Board of Trade draws attention to the following Orders signed on May 28th, by virtue of which the United Kingdom Trading with the Enemy Restrictions on private trade with Japan have been relaxed:—Trading with the Enemy (Authorization) (Japan) Order, 1947 (S.R. & O. 1947 No. 1031), Trading with the Enemy (Transfer of Negotiable Instruments, etc.)

(Japan) Order, 1947 (S.R. & O. 1947 No. 1032), and Trading with the Enemy (Custodian) (Amendment) (Japan) Order, 1947 (S.R. & O. 1937 No. 1033).

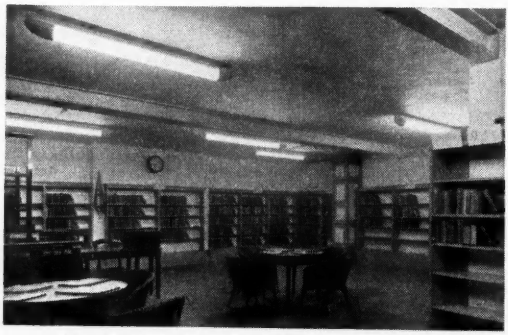
The general effect of these Orders is to permit trade in goods and transactions incidental thereto, with the Japanese State and private traders carrying on business in Japan, and to remove Board of Trade and Custodian control from any money or property arising in consequence of this authorization. Japanese money and property in the United Kingdom at the date of the Orders and income arising therefrom continue under Board of Trade and Custodian control.

Reports on German Industry

The latest reports published on German industry (obtainable from H.M. Stationery Office) include the following:—B.I.O.S. 1198. "Industrial Electronic Control" (3s. 6d.). F.I.A.T. 906. "Styroflex-Spiral Submarine Cable" (2s. 6d.). F.I.A.T. 992. "The Electrothermal Production of Aluminium Silicon Alloy" (1s.).

A Fluorescent Lighting Installation

Thorn Electrical Industries, Ltd., was recently awarded the contract for the lighting of the Children's Library at North Kensington, and the company employed its new "Atlas" FU/0080 enclosed ceiling fittings for this installation. The new fluorescent fitting incorporates a fluted Perspex diffusing cover, the units being self-contained with easy access to starter gear and tube.



New fluorescent lighting fittings in the Children's Library, North Kensington

The company has also recently installed its "Atlas" 80-W fluorescent lamps in Perspex fittings at Truefitt & Hill, hairdressers, of Old Bond Street, London, W.1.

European Engineers at Birmingham

Eight electrical engineers from Belgium, Czechoslovakia, Denmark and Italy will take part in a course arranged by the British Council at Birmingham between June 2nd and 13th. The course includes visits to the Birmingham City Electric Supply Department, the Hams Hall power station, the Central Electricity Board, the G.E.C. at Witton, the English Electric Co., Ltd., at Stafford, and the B.T.H. Co. at Rugby. During the course, the party will visit Stratford-on-Avon, Warwick and Broadway.

Canadian Electrical Production

Canadian production of refrigerators, electric stoves, washing machines and radio sets continues at a high level, but only sufficient to keep pace with consumer demand, according to a survey made by the *Financial Post*, Toronto. The only sign of a break in buying is in the radio field, where record output of table and mantel models has built up stocks. Many buyers, however, are awaiting console models, the completion of which has been delayed by shortage of suitable wood. The production of all types of radio sets is now 80,000 a month compared with a pre-war peak of 40,000; and the total for 1947 may reach 1,500,000. The number of washing machines made, which before the war was 9,000 a month at the most, rose to 12,368 in January and 15,000 in February, with most manufacturers confident of maintaining that level. Refrigerators showed an increase of more than 50 per cent on the pre-war monthly peak of 5,000. Stocks, in the normal business sense, of domestic appliances are said to be non-existent and there seems little likelihood of reductions of price; on the contrary, in view of increases in the price of steel and cost of labour manufacturers can only just continue without raising their prices.

Married Women J.E.A. Employees

The regulations of the London and Home Counties Joint Electricity Authority provide that upon marriage women employees shall relinquish their positions on the permanent staff and their superannuation fund contributions are returned to them. Then, if required, they are re-engaged on the temporary staff. At yesterday's meeting of the Authority the General Purposes Committee was to recommend the immediate revocation of this regulation.

Industrial Electronics

An article from *The Economist* has been reprinted in booklet form (MV. 100) by the Mullard Wireless Service Co., Ltd., with a brief introduction stressing the urgency of employing industrial electronics wherever it can contribute to the solution of manpower, production and quality problems. While agreeing that electronics may have been a little "over-

popularized," over fifty different applications claimed to be only the more important are listed while the article itself defines electronics, surveys its wide fields of application and gives some indication of economic factors involved in its use.

Bury Jubilee Exhibition

In connection with the jubilee of the Bury (Lancs.) electricity undertaking, a report of which appeared in our issue of May 9th, the Electricity Department held an electrical exhibition in its showrooms portraying fifty years of continuous progress of the undertaking. A feature of the exhibition was the large number of electrical appliances displayed, together with four model kitchens kindly lent by E.D.A. A full size E.D.A. No. 2 working kitchen and Poplar unit were also lent by the St. Helens Corporation. A section was allotted to the distribution side of the Department, and scale models were lent by various manufacturers, including a model substation, M.V. turbo-alternator, Reyrolle & B.T.H. air-blast switches, J. Thompson water-tube boiler and an assortment of canteen equipment by Stott's of Oldham. A number of local manufacturers also co-operated in supporting the industrial side of the exhibition.

Model substation shown at the Bury Exhibition

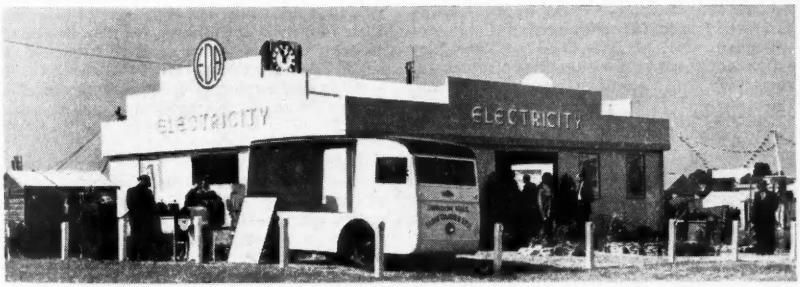
Municipal Radio Set Sales

Last year the Stoke Newington Borough Council, in common with a number of others, agreed to participate in a scheme for the sale of radio sets. A report presented by the Electricity Committee last week discloses that in November the Joint Committee of Local Authority Representatives set up in connection with the scheme decided no further orders should be placed with the original supplier. Subsequently a technical sub-committee consisting of the borough electrical engineers of local authorities participating in the scheme was appointed to prepare specifications for radio sets, so that other manufacturers could be approached.

Three sets were demonstrated to a meeting of the Committee in March and general agreement was expressed with their design. A well-known firm of radio manufacturers has since agreed to undertake the production of the sets for local authorities, and each Council has to place its own orders for the numbers of sets allocated. The prices to the Council of the three models, including purchase tax, are £14 0s. 2d., £20 14s. 2d. and £21 19s. (these may be increased in certain circumstances) and the cash selling prices are £16 15s. 4d., £24 15s. 9d. and £26 5s. 6d.

Trade Publications

E. H. Jones (Machine Tools), Ltd., Edgware Road, The Hyde, London, N.W.9.—Illustrated brochure describing " Sigma " inspection equip-



E.D.A. stand at last week's Bath and West Agricultural Show, held at Cheltenham

ment. Also a leaflet illustrating a portable hardness tester for laboratory and workshop or testing on site.

The Merchant Adventurers, Ltd., 43, Portland Road, London, W.11.—Illustrated and priced catalogue of decorative lighting pendants, wall brackets, table lamps and fluorescent fittings.

Plessey Co., Ltd., Ilford, Essex.—Four brochures dealing with variable condensers, trimmers and switches for radio purposes and of a new range of loudspeakers constructed by projection welding.

David Brown & Sons, Ltd., Park Gear Works Huddersfield.—Two handsome brochures on steel castings, alloy and carbon; also gearing for turbo-generators and general requirements.

Murex, Ltd., Rainham, Essex.—Series of booklets and leaflets of interest to metallurgists and users of fine chemicals, including leaflet (M.39) on hard facing " Tubex " welding rods.

Lewis Berger & Sons, Ltd., 35, Berkeley Square, London, W.1.—Illustrated brochure on " Hy-Meg " insulating varnishes and compounds with technical data.

Trade Announcements

The London sales depot of the Chloride Electrical Storage Co., Ltd., evacuated to Richmond in the early days of the war, is now established at Whitfield House, 6-10, Whitfield Street, Tottenham Court Road, London, W.1 (telephone: Museum 1616).

Trade Marks

THE following applications have been made for trade marks. Objections may be entered within a month from the date given:—

May 21st

SKILSAW. No. B631,269, Class 7. Drills, saws, grinders and sanders, all being portable electrically-driven tools. Skilsaw Inc., Chicago. Address for service: c/o McKenna & Co., 12, Whitehall, London, S.W.1.

FLEXELF. No. 643,797, Class 9. Coiled insulated wire for electrical connections.—Cordage Inc., 6650, South Cicero Avenue, Chicago. Address for service: c/o Frank B. Dehn & Co., Kingsway House, 103, Kingsway, W.C.2.

UNILAG. No. 645,353, Class 9. Time-delay action contrivances for use in controlling the operations of electrical and mechanical apparatus.—H. E. R. Thomas, The Homestead, Crick, near Rugby.

INDUSTRY ANT. No. 645,676, Class 9. Electrical apparatus and instruments not included in other classes.—Antiference, Ltd., 7-12, Plender Place, Plender Street, N.W.1.

VACKAR. No. 647,363, Class 9. Electric vacuum cleaners and parts thereof (not included in other classes).—Black & Decker Mfg. Co., Baltimore, U.S.A. Address for service: c/o McKenna & Co., 12, Whitehall, S.W.1.

TRANSTAR. No. 647,473, Class 9. Apparatus embodying electric transformers and choke coils for use in starting electric discharge lamps. Sturdy Electric Co., Ltd., Dipton, Newcastle-on-Tyne.

BANCO (design). No. 646,066, Class 11. Electric fires.—Banham & Co., Ltd., 30, Fleet Street, London, E.C.4.

PYRADEX. No. 646,461, Class 11. Table lamps and wall bracket lamps.—J. Wippell & Co., Ltd., 55-56, High Street, Exeter.

ELECTRO-VIS. No. B656,983, Class 17. Electric insulating compositions in liquid or semi-solid form.—Astor Boisselier & Lawrence, Ltd., 69-70, Mark Lane, London, E.C.3.

May 28th

TELCON. No. 647,366, Class 6. Unwrought or partly wrought common metals and their alloys; and wires (not insulated or fuse wires) and non-electric cables, all of common metal. Also No. 647,367, Class 9. Electrical apparatus and instruments included in Class 9 and nautical measuring and sounding apparatus.—Telegraph Construction & Maintenance Co., Ltd., 22, Old Broad Street, London, E.C.2.

ISOTROL. No. 644,187, Class 7. Electric motors (not for land vehicles).—Lancashire Dynamo & Crypto, Ltd., Trafford Road, Trafford Park, Manchester, 17.

CYCA. No. 647,719, Class 7. Dynamos.—Cycalite, Ltd., 47-59, Hopton Street, Southwark, London, S.E.1.

EUREKA (design). No. 638,723, Class 9. Radio apparatus, electric coffee percolators, and electrically-operated openers for garage doors.—Eureka Vacuum Cleaner Co., Detroit. Address for service: c/o Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

LITHOTEX (design). No. 647,500, Class 11. Electric lamps and arc lamps, all for use for photographic purposes.—Pictorial Machinery, Ltd., 51, Highgate High Street, London, N.6.

Export Inquiries

WE have received the undermentioned inquiries from firms and individuals overseas who wish to secure agencies for British electrical equipment and appliances or to import them into their territories. We shall be glad to pass on to them replies received from readers, which should be addressed to the Editors, quoting the number given in parentheses. We cannot vouch for the standing of inquirers and manufacturers replying to them will no doubt require the usual references:—

Hong Kong.—A firm of importers and agents wishes to get into touch with manufacturers of electrical equipment of all kinds with a view to representing them. (X.182.)

Sweden.—London agent of Swedish concern wishes to purchase British time-switches, oil-filled switchgear, motor starters and protective gear, and chokes for fluorescent tubes. (X.183.)

Acidity and Sludge

Their Formation in Transformer Oil

By J. A. Clegg, M.Sc.(Eng.)

FIVE conditions aid acidification and sludging of transformer oil. These are: Temperature of oil (acidification like most chemical reactions increasing with temperature) and the presence of oxygen in contact with the oil, moisture, catalysts such as copper and materials which may dissolve in or react with oil. The investigations here described do not deal with the chemical processes involved but with the discovery of practical remedies. All the experiments were carried out on B.30 oil.

Effect of Temperature

To determine the influence of temperature, samples of oil were exposed to the atmosphere and maintained at the temperatures shown in Table 1 for equal periods and the acid and sludge values measured. There was very considerable increase in sludge formation at the higher temperatures but also a tendency for the acid value to increase at a lower rate with increasing temperatures, due, presumably, to the increased volatility of the acids formed.

Tests to find out the effects of catalysts, etc., were accelerated by being carried out at temperatures above the normal working ranges.

Table 1

Temperature, deg C	Acid value*	Temperature difference, deg C	Temperature, deg C	Sludge, per cent	Temperature difference, deg C
15	0·018	70	130	0·03	20
85	0·53		150	0·15	
130	0·30	20	130	0·07	20
150	0·85		150	0·35	

* The acid value is expressed throughout in milligrammes of KOH per 100 g of oil.

Presence of Oxygen

Since oxidation is the main cause of deterioration of transformer oil and in practice its proportions can be limited either by the use of a conservator or a hermetically sealed unit, the following test was carried out under controlled conditions.

A glass flask, lightly corked and fitted with a long-stemmed funnel, was filled with oil and placed in a thermostatically controlled oven so that the funnel projected through the top, thus acting as a reservoir for cold oil. The end of the funnel was closed by a loosely fitting stopper to minimize the access of air. An open glass beaker was placed in the oven by the side of the flask and air was passed slowly through the oven so that this sample was freely exposed to oxygen. The temperature of the oven was kept at 130 deg C ±2 deg C for 200 hours, the temperature in the reservoir of the oil exposed to the air being 40 deg C.

After this experiment, the oil in the open beaker was very dark brown with considerable sludge and an acid value of 0·40, whereas in the enclosed specimen there was little change in the colour and an acid value of only 0·09.

The test was then repeated with the addition of equal amounts of copper foil in each to act as a catalyst. After 72 hours the acid values were 1·68 and 0·09 respectively, with very considerable sludge in the exposed sample and none in the protected case.

Moisture Test

As in practice the humidity of the air in contact with the oil can be controlled by the use of a silica-gel breather, this method was employed in determining the effect of moisture in accelerating deterioration. Moist air was passed through a sample of oil at 130 deg C, while dry air was passed at the same rate through a similar sample. Consistent results were not obtained, however, as the difference in the rates of deterioration of the two samples, due to the inevitable difference of air-flow rates, was greater than the difference due to the effect of moisture. It seems reasonable to assume that the effect of moisture is not important, a conclusion that is borne out by other investigations.

As the provision of adequate escape for any volatile acid products of deterioration may be important in practice, an experiment

was carried out to determine the character of these products.

A flask of oil containing 100 grammes was maintained at 150 deg C, a rapid stream of air being bubbled through and passed through a condensing cylinder into a receiving flask and thence through a column of oil. After 72 hours a quantity of liquid was collected in the condenser flask having an acid value of 11·22 milligrammes of potassium hydroxide; in addition, the air when escaping still carried with it acid fumes.

It appears, therefore, that as the oil deteriorates volatile acids are formed, which, if the oil is contained in a tank, will condense on the lid, and are, no doubt, responsible for lid corrosion. In a hermetically sealed transformer, deficiency of oxygen will arrest deterioration. The worst case, however, is the normal one in which a small " breathing " hole is provided to secure a continual supply of oxygen, the acid products condensing on the lid and falling back in the oil to act as catalysts and so increasing the rate of deterioration. It has been proved by other investigators that the acids themselves act as catalysts.

Action of Catalysts

In order to decide the relative action of the materials that are commonly used in contact with oil, the following series of tests were made. The first series (Nos. 2 to 7) was carried out on samples of oil in sheet-steel containers with the addition of the catalysts shown in Table 2, the samples being subjected to a temperature of approximately 90 deg C.

Table 2

No.	Sample	Acid value after exposure for number of weeks stated					
		1	2	3	5½	9	12
1	Glass beaker ..	0·02	0·02	0·02	0·03	0·03	0·03
2	Steel container ..	0·02	0·04	0·05	0·11	0·11	0·11
3	+ copper foil ..	0·14	0·24	0·26	0·54	0·58	0·58
4	+ coil in varnish A	0·15	0·16	0·19	0·29	0·40	0·39
5	+ coil in varnish B	0·09	0·09	0·10	0·16	0·19	0·18
6	+ coil in varnish B*	0·11	0·13	0·13	0·18	0·20	0·20
7	+ cotton tape ..	0·05	0·04	0·04	0·07	0·07	0·07

* In this coil the evaporation of the solvent polymerization of the varnish was not complete.

A sample of oil (No. 1) was also kept in a glass beaker to act as a standard of reference.

Catalysts clearly have a considerable effect on the acidification of oil, copper being the most marked. A further series of tests was made at a higher temperature for 72 hours on samples in glass containers with the various materials used in transformer manufacture. The presence of cotton tape decreased the rate of acidification, due presumably to alkaline impurities. The tests were carried out at 130 deg C to decrease the time required and a constant area of catalyst (14 sq cm) was exposed on all tests (Table 3).

Table 3

Volume of Oil 250 deg c.c. Catalyst	Acid value, mg of KOH	Sludge, grammes
None	0·20	—
Cork	0·21	—
Bakelite to B.S.S.316	0·21	—
Pure aluminium	0·22	—
Commercial bakelite	0·28	—
Iron painted with red primer ..	0·29	0·001
Glass coated with varnish B ..	0·27	
Copper coated with varnish B	0·34	0·0025
Tin on copper	0·34	0·140
Nickel on copper	0·34	0·183
Aluminium alloy	0·34	0·057
Nickel on iron	0·36	
Cadmium on iron	0·45	0·096
Anodized aluminium alloy ..	0·53	0·585
Silver on copper	0·53	0·079
Nickel on brass	0·53	
Tin on brass	0·63	0·21
Iron coated with oil-resisting varnish	0·65	0·45
Iron descaled and clean ..	0·65	
Presspahn	0·68	0·145
Galvanized iron	0·76	0·188
Zinc on iron	0·88	0·295
Brass	1·17	0·236
Copper	1·41	0·692

These tests show copper to be the most effective catalyst, but its influence is less serious if coated with a suitable varnish, as is normal practice. Clean iron was fairly high in the table, but a normal coat of paint reduced the action to a very low value, although an oil-resisting varnish made no difference, presumably because the thin coat applied did not efficiently cover the rough surface. It is to be noted that sludge formation and acid value do not always accompany one another in the same ratio.

Impregnating Varnish

To determine the effect of the varnishes commonly used in transformer manufacture, a series of tests was carried out in which 5 g of baked varnish was immersed in 100 c.c. of transformer oil and maintained at 130 deg C ±2 deg C. Three samples of each varnish were prepared: A, overbaked (10 deg C over the recommended temperature); B, correctly baked; C, underbaked (10 deg C below recommended temperature). The results of the tests are shown in Table 4.

These tests indicate that while some varnishes have a very marked effect on deterioration, the effect of others is com-

paratively small. Varnish No. 1 was dissolved by the oil, causing discoloration, and would not normally be used in an oil-immersed transformer, but this argument does not apply to the other two bad varnishes, Nos. 5 and 6.

These tests show that certain factors accelerate the deterioration of oil but that by taking precautions during design and manufacture the effects can be controlled and diminished. Even under the best conditions, however (no contact with air and absence of catalysts) there is some deterioration at the temperatures that are likely to be met in practice (i.e., up to 90 deg C). On the other hand, transformers have been in use for many years in anything but ideal conditions without there being any serious deterioration.

General Conclusion

It has not been possible in these investigations to determine whether some supplies of oil are more prone to deterioration than others. The results, therefore, can be considered only in the light of practical experience, and for transformer oil used generally in the past ten years most of the trouble would seem to be accounted for by high oil temperatures due to overloading or to hot spots in the windings, particularly as acidification once having started is cumulative in effect. Experience would suggest that if a transformer of good design is run at normal temperatures, no trouble should ensue. If, however, high ambient temperatures or a continued high load factor are expected, either a hermetically sealed transformer or one having a conservator should be used, so that the contact of air with hot oil is reduced. The tests indicate that bare metal of any kind should be avoided where possible, particularly copper, which, however, can be adequately protected by a coat of suitable varnish.

Varnishing the inside of the tank is an advantage, although many manufacturers have preferred to sand-blast the interior of the tank and leave it untreated under oil level. Moisture has little effect, so that the fitting of a dehydrating breather is not important on that account, as it is in maintaining the dielectric strength of the oil. The choice of varnish again is of importance and the tests above indicate a type which is not likely to cause trouble.

The author wishes to acknowledge his indebtedness to Gresham Transformers, Ltd., for whom the tests described in this article were carried out.

Table 4

Varnish code No.	Acid value after the following hours at 130 deg C				
	22	70	150	220	300
Blank (Pyrex glass)	0·15	0·20	0·25		
1C	1·12	1·43			
1A	1·18	1·36			
2C		0·48	0·55	1·12	
2A	0·36	0·42	0·52	0·93	
3C	0·39	0·66	0·75		
3A	0·50	0·50	0·64		
4C	0·23	0·30			
4A	0·30	0·35			
5C	1·02	1·69			
5A	1·27	1·49			
6C	0·52	1·23	1·29	2·02	
6A	1·43	1·61	1·47		
8C		0·82			1·54
10C		0·77			1·54
12C		0·39			1·25

U.S. Exports to Russia

ACCORDING to official returns issued in Washington, United States exports of electrical goods to Soviet Russia during the first half of last year totalled $22,805,000, compared with $70,400,000 during the first six months of 1945. The values of the principal groups with notes of decreases and one increase only are given below. Generators numbered 127 and Diesel-powered generator sets 247, while the m.g. type welding sets numbered 305. Nearly half the exports were Lend-Lease "pipe-line" shipments, namely goods contracted for during the war but moved forward after VJ-day under a 30-year credit agreement. It will be seen that heavy decreases are shown, notably in generators and radio apparatus. In connection with Soviet Russia's ambitious power supply plans it is claimed that the electrical engineering industry of the U.S.S.R. can meet all requirements.

Class of Goods	First half 1946 $000	Inc. or dec. on first half 1945 $000
Batteries	716	— 1,484
Generators	4,456	— 8,044
Accessories and parts for generators	440	— 660
Welding sets, motor generator types	900	— 300
Generating sets, Diesel-powered	1,658	— 12,542
Transforming and converting apparatus	1,055	— 2,145
Motors, starters & controllers	6,980	+ 880
Searchlights	16	— 784
Industrial heating devices	2,300	— 700
Radio apparatus	600	— 13,700
Telephone instruments	3	— 2,397
Telephone equipment & parts	270	— 1,430

Scottish Sales Conference

Papers Presented at Edinburgh

MR. J. F. FIELD, city electrical engineer, Edinburgh, presided at the opening session on May 29th of a sales conference organized by the Scottish Area Committee of the British Electrical Development Association at the lecture theatre of the Edinburgh Electricity Department's showrooms, George Street.

After the chairman's introductory remarks Mr. R. Lonsdale, deputy burgh electrical engineer, Paisley, read a paper on "Electric Water Heating" in which he deprecated rigid adherence to one type of heater, suggesting that individual consumers' needs should be studied. He presented diagrams to show that electric water heating under proper conditions actually required less coal than a domestic coal boiler or a gas system. Mr. Lonsdale reviewed at some length the construction and characteristics of all types of electric water heating equipment and installations, giving particulars of initial and running costs.

Service Department Operation

After luncheon a paper on "The Operation of a Service Department of an Electricity Supply Undertaking" was read by Mr. J. G. Curtis, deputy burgh electrical engineer, Kirkcaldy. Mr. Curtis stressed the necessity of advice and after-sales service for domestic consumers, showrooms, and prompt attention to inquiries and had something to say on mobile showrooms and showroom staff. It was explained how good relations could be established by studying the consumers' convenience and wishes in putting in service cables and meters. The desirability of maintaining harmonious contact with electrical contractors by regular meetings was another point.

Mr. Curtis went on to outline means of keeping the consumer satisfied, touching upon such matters as continuity of supply, voltage regulation, instruction in the use of apparatus, hire and hire-purchase and regular inspection. Special service facilities for industrial and commercial consumers were recommended. The author described the organization and operation of a consumers' department with which he was formerly connected.

On May 30th Mr. C. H. A. Collyns, general manager, Lothians Electric Power Co., was chairman when Mr. W. Duncan, consumers' engineer, Edinburgh, read a paper entitled "Electrical Installations, Particularly in Housing Schemes"—installations including appliances. Mr. Duncan showed how the attitude of the "authorities" towards electricity in housing schemes had changed for the better and went on to deal with the characteristics of the various wiring systems, emphasizing the need for adequacy. Requirements in the way of lighting, cooking, space and water heating and refrigeration were briefly covered and the author concluded with a warning against being "penny wise and pound foolish" in installations.

Sales engineers' problems formed the subject of the afternoon session when Mr. A. B. Mavor, consumers' engineer, Lothians Electric Power Co., presented the rural point of view and Messrs. R. S. Goddard and G. Fowler, of the Dundee Electricity Department, spoke from the urban aspect. Mr. Mavor first pointed out the difficulties encountered among sparse and scattered populations—largely on account of costs. Nevertheless there had been extensive rural development partly to the credit of sales engineers—whom he would prefer to call "development and consumers' engineers."

The author dealt with the types and nature of the loads encountered in rural areas and urged the importance of maintenance. Other matters covered in the paper included the registration of contractors, co-operation with architects, hire and hire-purchase, tariffs and slot-meters, development tendencies, tar boilers and all-electric houses.

Selling Methods

Messrs. Goddard and Fowler's paper surveyed the course of electricity supply during the past few years towards the goal of abundance and cheapness. They considered that the continuance of restrictions on domestic usage would work permanent harm. An abundant, but not unlimited, supply of electricity was expected and wanted especially for domestic purposes. Cheapness was a relative term; the cost of electricity had not advanced to the same extent as the cost of coal and gas.

"Merchandising" and installation of appliances by electricity supply undertakings was advocated; it was contended that often electrical contractors were at cross purposes with one another and with the authority, to the confusion of the consumer. Domestic sales development necessitated two-part tariffs with a low secondary charge. After some remarks upon the discouragement by supply authorities of space heating, the authors advocated the fostering of the water-heating load as one of great value and simple all-in hire schemes for electric cookers. The paper concluded with some notes on general development and hailed the Electricity Bill as another step towards total electrification.

On May 31st Mr. P. Honey, of E.D.A. headquarters staff, presented a report on the conference held in London earlier in the month. A film show followed and in the afternoon there were visits to Portobello power station, Bruce Peebles' works, a coal mine and the Lothian Electric Power Co.'s area.

ELECTRICITY SUPPLY

Nottingham Extensions. Possible Rationing in Sweden.

Aberdeen.—GRIT ARRESTING PLANT.—The North of Scotland Hydro-Electric Board has given authority for erection of additional grit-arresting plant at the power station in Crown Street at a cost of approximately £38,000.

Accrington. — ELECTRICITY SUPPLY. — Technicians from two firms have recently visited Accrington in connection with a proposal to equip Hyndburn Road electricity station as a distributing station. It was reported to the Electricity Committee that further consideration should be given to an alternative suggestion of establishing three main feed points with the ultimate development of a 33,000-V ring main system. The matter has now been referred to a special committee for report.

Battersea.—ELECTRICITY DISCOUNT DOUBLED. —Because its electricity undertaking will have accumulated the net surplus of £63,829 by next March the Borough Council has decided to pass on the benefit to consumers through an additional 5 per cent discount, making 10 per cent in all on all accounts. The reduction will result in a saving to consumers of £16,500.

Bermondsey.—REFUND FOR METER DISCREPANCY.—A refund of 5 per cent on all electricity accounts for the January-March period this year was sanctioned last week by the Borough Council. The reason given for the refund is that the electricity meters recorded slightly more consumption than the actual amount owing to voltage reductions.

Chesterfield.—RE-ZONING OF UNDERTAKING.—The transfer of the undertaking from Zone B to Zone A in the national wages agreement schedule means an increase in the rate of pay of employees with effect from February 1st of this year.

REVISION OF CHARGES.—Tariff revisions recommended by the Electricity Committee include increases in the lighting flat rate from 3d. to 3½d. per kWh and the heating, cooking, etc., rate from ¾d. to ⅞d. The two-part tariff fixed charge, hitherto calculated on the previous year's consumption, is now to be on the basis of the floor area of premises, and the running charge will be 0·55d. per kWh. For business premises the fixed charge is to be £10 per kW per annum, plus ⅞d. per kWh. Special tariffs for churches, cinemas, licensed premises, etc., are to be discontinued. On the other hand, meter rents will no longer be charged except where meters are required for special purposes.

Darlington. — HIGHER CHARGES RECOMMENDED.—Having considered reports on the accounts of the electricity undertaking, the Gas and Electricity Committee has decided to recommend an addition of 33⅓ per cent to charges instead of the present 15 per cent "war" increase, subject to the approval of the Electricity Commissioners. The revision would take effect from the end of the present meter readings.

Grimsby.—SURCHARGE ON ACCOUNTS.—In spite of strong opposition at the meeting of the Town Council on May 28th it was decided that the Electricity Committee's recommendation that the present 15 per cent surcharge on accounts should be reduced to 7½ per cent should be referred back for further consideration. It was contended that a £62,000 reserve fund provided by consumers ought to be repaid to them as "it might as well be given away as handed over on nationalization."

Guildford.—FACTORY SUPPLY.—The Twentieth Century Leather Co., Ltd., has applied to the Borough Council for an increased supply of electricity for power purposes at its factory at Ladymead. The estimated cost is £1,128.

HOUSING DEVELOPMENT.—The Council has under consideration a scheme for the supply of electricity to a new housing estate at West Clandon at an estimated cost of £2,815. Hambledon R.D.C. has requested a supply (estimated to cost £2,032) to a new estate at Bramley which is to consist of sixteen permanent houses.

Ipswich.—INDUSTRIAL SUPPLIES.—Application for loan sanction is to be made by the Council to cover an estimated expenditure of £14,154, to provide additional supplies of electricity to Crane, Ltd., Ransomes, Sims & Jefferies, Ltd., and Reavell & Co., Ltd.

Llandudno. — TARIFF FOR "PREFABS." — A suggestion has been made to the Electricity Committee that tenants of prefabricated houses should be offered a tariff comprising a fixed charge of £3, plus a "unit" charge of ¾d. for all electricity consumed. A tariff on these lines is to be considered for adoption throughout the town, as the Electricity Commissioners have drawn attention to the fact that preferential treatment must not be given to any one section of the community.

London. — TRANSMISSION REINFORCEMENT.— The London and Home Counties J.E.A. has received the sanction of the Electricity Commissioners to a loan of £150,000 in respect of mains (£50,000) and plant (£100,000) for the reinforcement of the main transmission system at Esher, Twickenham and Sutton. The total cost of the scheme is estimated at £162,755.

Nottingham.—NORTH WILFORD EXTENSION.— In order to increase the power supply for industrial purposes, the Central Electricity Board has directed the Corporation to spend £1,708,145

on a further extension of the North Wilford power station, to bring its capacity up to 254,000 kW.

The Corporation is asked to install a turbo-alternator set having a maximum continuous rating of 52,500 kW, as well as two boiler units each with a maximum continuous evaporative capacity of 320,000 lb of steam per hour, together with the necessary ancillary plant, buildings and civil engineering works. The Board requires these to be ready to go into commercial operation by September, 1949.

Pontefract.—TRANSFER OF UNDERTAKING.—Application has been made by the West Riding Automobile Co. Ltd., for a Special Order for the transfer from the West Riding Co. to the Pontefract Electricity Co., Ltd., of the undertaking authorized by the Pontefract Corporation Orders 1907 and 1912.

Spenborough. — ESTATE LIGHTING. — The Council has accepted a tender by the General Electric Co., Ltd., for street lighting equipment for the Windy Bank estate, and is negotiating with the Electrical Distribution of Yorkshire, Ltd., for a supply of electricity for the purpose.

Stepney.—METERS.—The Borough Council is recommended to approve expenditure of £15,000 for a.c. meters, and £10,000 for d.c. meters.

Stoke Newington.—RING MAINS.—Proposals by the borough electrical engineer for the modification of the e.h.v. network to cater for the additional load through housing development have been approved by the Electricity Committee. The e.h.v. cables are to be rearranged to form three separate ring mains.

Overseas

Eire.—BUDGET ESTIMATES.—The Budget presented by the Minister of Finance (Mr. Frank Aiken) provides for an expenditure of £2,000,000 under the Electricity (Supply) Acts and £1,550,000 under the Turf Development Act.

Sweden.—HYDRO-ELECTRIC OUTPUT. — Power production increased during 1946 by 500 million kWh to 14,000 million kWh, states the Swedish Water Power Association in its annual report. The building of hydro-electric plants aggregating 489,000 kW was commenced during 1946 and new plants with a capacity of 47,000 kW were commissioned. The exploited water power in Sweden amounted at the end of the year to 2,576,000 kW; after completion of plants at present under construction this figure will rise to 3,569,000 kW.

POSSIBILITY OF RATIONING.—The Government Fuel Commission has announced that rationing of electricity seems unavoidable owing to the serious water supply situation in the country's lakes and rivers combined with the scarcity of coal and the growing requirements of electric power on the part of industry. As a first step in the efforts to save power, it is reported that the use of electric heaters is to be prohibited. There will also be considerable restrictions on display-window and publicity illumination. The allocation of electrical energy to private households is expected to be carried out in the same way as the rationing of gas, which was in force until quite recently, i.e., each household will have its "ration" calculated in accordance with its normal consumption.

United States.—LARGE SET FOR CHICAGO.—The *Electrical World* says that the Commonwealth Edison Co., plans to add a 150,000-kW turbo-generator to its Fisk plant in Chicago, raising its capacity to 473,000 kW. The cost of the unit is put at $15·5 million and it is scheduled for service by the summer of 1949.

TRANSPORT

Glasgow.—COST OF PINKSTON SCHEME.—The estimated cost of the additional generating plant and conversion of the system to standard frequency at Pinkston power station approved by Glasgow Municipal Transport Committee is given in the Corporation minutes as follows:—Installation of 30,000-kW machine, £390,000; two new boilers, £470,000; cooling tower, £200,000; new switchgear, £264,900; conversion of existing substations, £284,230; new substations, £56,720 (Possilpark), £45,950, (Balshagray) and £77,700 (Hillington); change of frequency (car works, etc.), £10,500.

Illuminating Engineering Society

AT the annual general meeting of the Illuminating Engineering Society held on May 13th, the president, Mr. J. S. Dow, presented the Report of the Council for the year ending December 31st, 1946. Though recovery to normal conditions had not been as rapid as might be desired the Society had continued to make good progress both as regards activities and membership. For the first time the Council was able to report that membership had topped the 2,000 mark. In the year under review a further centre was opened, holding meetings alternately at Gloucester and Cheltenham. The outstanding event of the year was the Society's first Convention, held in London.

The president announced the result of a ballot of members that had been taken on the proposal to form a Register of Lighting Engineers. Under the scheme the names of those corporate members who fulfil certain conditions may be included in a Register and are entitled to the exclusive use of the description "Registered Lighting Engineer (I.E.S.)." This proposal was approved by a large majority.

On conclusion of formal business the president introduced Dr. N. A. Halbertsma, president of the International Commission on Illumination, who delivered an address entitled "International Relations in Illuminating Engineering."

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

London Associated Electricity Undertakings, Ltd.—At the annual meeting held recently the Earl of Lytton (chairman), in reviewing the country's electricity supply position, referred to the need for a national manufacturing programme in order to speed up the supply of new generating plant and said that he was glad the Government had issued new directions to the manufacturers. There was also a grave shortage of many items of distribution plant such as transformers, cable switchgear and service apparatus, and he would like to hear of similar action being taken by the Government in this connection. In criticizing the Electricity Bill, the chairman referred to the unfair compensation terms.

The operating company, Central London Electricity, Ltd., had had a successful year. The number of consumers increased during the year by 6,800 and the sales rose by 67¾ million kWh to over 450 million kWh.

Siemens Bros., Ltd.—An extraordinary general meeting was held on May 30th at which resolutions increasing the capital of the company from £3,000,000 to £4,000,000 by the creation of 1,000,000 4 per cent. cumulative redeemable second preference shares and the alteration of the articles of association consequential thereto were passed unanimously.

The chairman (Dr. H. R. Wright) stated that the documents relating to the offer of the shares will be sent out to the stockholders at the same time as the company's annual accounts and notice of the annual general meeting, which will be held towards the end of this month or early in July.

British Insulated Callender's Cables, Ltd.—Some details of the company's trading for the eighteen months to December 31st last were given in our May 16th issue. The full accounts now issued show that the consolidated trading profit and miscellaneous receipts, plus interest and dividends and profit on sales of property, etc., amounted to £3,525,528, with a net figure of £2,722,143 before providing £1,508,556 for taxation. The group's total assets amount to £27,086,000, with current assets at £16,899,023, and current liabilities and provisions at £8,528,506.

In a statement accompanying the accounts the chairman, Sir Alexander Roger, after referring to the tremendous amount of work which followed the amalgamation of British Insulated Cables and Callender's Cables, states that the progress made is fully up to expectations while steps have been taken to achieve the long-term objects of the merger. Commenting on the accounts, he says that the company's free net current assets are probably insufficient to meet its needs, but until prices are more settled and long-term requirements can be more accurately ascertained the board proposes to depend on the bank for any temporary finance required.

With regard to the outlook, the chairman says that the main factors preventing maximum production are shortage of operatives and an unprecedented shortage and irregular flow of raw materials and component parts. He suggests that the Government should pause in its doctrinaire policies and instead guide and sympathetically help all industry to maximum production in the ways which are understood and which have proved successful. It should restore the merchants, dealers and middlemen to their old and experienced functions, revivify the metal, produce and cotton markets and shipping, and give fresh encouragement to directors and all other grades of management.

As an immediate result of the fuel crisis the company lost the equivalent of three full weeks' production, while supplies of raw materials, etc., have gone from bad to worse with no immediate relief in sight. From the sales aspect, the outstanding feature has been the overwhelming demand, and the company has reached the point of having to consider the question of declining further orders because of the virtual impossibility of forming a reasonable estimate of probable future trading. The company is pressing forward with the reorganization of existing factories and outstanding commitments amount to over £1,500,000.

C. A. Parsons & Co., Ltd.—The subscription list opened on Wednesday in connection with the issue to the public of 600,000 4 per cent redeemable cumulative preference shares of £1 each at 21s. 6d. per share, with preferential consideration for shareholders and employees. Redemption of the shares is at 21s. 6d. in liquidation and at 22s. 6d. after January 1st, 1962. In addition 250,100 ordinary shares of £1 were offered at £3 each to existing shareholders and employees. The prospectus stated that the volume of work in hand was several times higher than at any previous time in the company's history and amounted in value to approximately £15,000,000. At December 31st last work in progress amounting to £2,402,000 was being financed by bank overdraft to the extent of £1,293,000.

Richard Johnson & Nephew, Ltd.—At the recent annual meeting Mr. A. T. Johnson, who presided, said that their output of steel wire was, with one exception, the lowest for eleven years, and to-day they were working at a much lower level than at the beginning of the year. The main difficulty was the shortage of steel,

the receipts of billets during the year under review being only two-thirds of the tonnage received during the immediate pre-war period. The position of the non-ferrous side of the business was more satisfactory. The output had increased by about 50 per cent over the previous year. Copper had been scarce at times, but they had never actually had to curtail production through lack of supplies. There was a tremendous demand for their products both in the home and export markets. There had also been a heavy demand for steel-cored aluminium conductor, but their ability to meet it had been considerably restricted by shortage of steel.

The Calcutta Electric Supply Corporation, Ltd.—Presiding at the annual meeting held on May 21st, Sir James Donald (chairman) said that this year was the jubilee year of the company, and to-day they had three stations with a capacity of 270,000 kW, to be raised within the next few years to 470,000 kW. Developments on a large scale were envisaged in the immediate future, demanding a heavy programme in the extension of the generating plant and in extensive measures of distribution. The future would be full of promise, but omens were that the company's interests in the supply of electricity to Calcutta were likely to pass into other hands. The sales of electricity fell from 669 million kWh in 1945 to 614 million kWh in 1946. Costs had risen and they had increased the flat rate from two to two and a half annas as from January 1st last. Revenue from the sale of electricity was more than half a million pounds higher than in the previous year, notwithstanding that reductions were made in September last.

Automatic Telephone & Electric Co., Ltd.—Profits for 1946 amounted to £456,942, including £193,000 revenue provisions no longer needed (this compares with profits of £658,304 in 1945, after deducting £177,412 additional revenue provisions required). E.P.T. absorbs £136,046 (£320,057), directors' fees £1,624 (£2,279), depreciation £80,701 (£75,894) and income tax on the year's profits £131,562 (£138,381). There is no transfer to reserve (against £18,000). It is proposed to pay a final dividend of 7 per cent on the ordinary stock and a cash bonus of 2½ per cent, again making a total of 12½ per cent for the year, and a dividend of 10 per cent plus a cash bonus of 2½ per cent (same) on the deferred stock and shares. A sum of £178,360 (£150,852) is carried forward.

Ransomes & Rapier, Ltd., report a net profit for 1946, after tax, of £47,666 (against £30,661). It is proposed to raise the final ordinary dividend from 4 to 5 per cent tax free, making 7 per cent (against 6 per cent) tax free for the year. The new ordinary stock ranks for half of the rate.

Glenfield & Kennedy, Ltd., report a trading profit for the year ended March 31st, after E.P.T., etc., of £107,822 (against £110,437 for 1945-46) to which is added £72,246 (£18,400) dividends from subsidiaries. The net profit was £100,296 (£63,950), after providing £76,428 (£63,710) for income tax. A sum of £20,000 (nil) is transferred to general reserve and the ordinary dividend for the year is maintained at 20 per cent, the new shares issued in September ranking for one-third of this rate. A consolidated statement gives the trading profit of the group after E.P.T., etc., as £245,825, with a net profit of £118,261.

H.T.A., Ltd.—This company—formerly Hall Telephone Accessories (1928), Ltd.—reports a net trading loss of £73,195 for 1946 compared with a loss of £59,722 for 1945. Recovery of E.P.T. paid leaves a credit balance of £81,805 (£105,278). It is proposed to maintain the ordinary dividend at 10 per cent.

Johnson, Matthey & Co., Ltd., with a final dividend of 3 per cent and a bonus of 6 per cent, are maintaining the distribution for the year at 12 per cent.

Edmundsons Electricity Corporation, Ltd., reports a net profit for the year ended March 31st last of £647,362, compared with £572,397 for 1945-46. The final ordinary dividend is 3 per cent (against 3½ per cent), which with the increased interim dividend maintains the distribution for the year at 6 per cent.

The Southern Areas Electric Corporation, Ltd., reports a net profit for the year ended December 31st last of £25,352, as compared with £26,445 for the preceding year, to which is added £13,099 brought in, making £38,451. The dividend for the year is maintained at 5½ per cent, less tax, and the balance carried forward is £14,751.

The Sheerness & District Electric Supply Co., Ltd., reports a revenue for 1946 of £44,935, as compared with £41,596 for 1945. After meeting various charges, it is proposed again to pay a dividend of 10 per cent for the year and to carry forward £11,832 (against £8,577 brought in).

The Lewes & District Electric Supply Co., Ltd., reports a net revenue for 1946 of £21,072, as compared with £17,765 for the preceding year. The dividend for the year is unchanged at 10 per cent, and £6,758 is carried forward (against £3,279 brought in).

Crompton Parkinson, Ltd., have declared an an unchanged dividend of 7½ per cent on the ordinary and "A" ordinary stock.

The London Electric Wire Co. & Smiths, Ltd., is raising its interim dividend from 2 to 2½ per cent.

Broom & Wade, Ltd., have declared an interim dividend of 7½ per cent (same).

Aeronautical & General Instruments, Ltd., has announced an interim dividend of 7 per cent against 6½ per cent last year.

The Lisbon Electric Tramways, Ltd., is paying a final dividend of 2½ per cent, tax free, maintaining the distribution for the year at 5 per cent

New Companies

Oerlikon (Reconstructed), Ltd.—Registered May 21st. Capital, £500. To acquire the business of Oerlikon, Ltd. (in liquidation), and to carry on the business of electrical, hydraulic, mechanical and general engineers, etc. Directors: M. H. Schindler and F. E. Hirt. Secretary: R. A. Burgess. Regd. office: Victoria House, Southampton Row, W.C.1.

Teleview, Ltd.—Registered May 21st. Capital, £2,000. Manufacturers of, and dealers in, radio and television sets, etc. Secretary: W. G. Curtis. Regd. office: 52d, High Street, Southend-on-Sea.

"Alga" Domestic Appliances, Ltd.—Registered May 21st. Capital, £500. To acquire the business carried on at 72a, South Island Road, S.W.9, by H. Ludicke as L. & C. Electrical Co. and to carry on the business of manufacturers of, and dealers in, electrical and domestic appliances and devices, etc. Secretary: H. Ludicke. Regd. office: 72a, South Island Road, S.W.9.

Harry Tams, Ltd.—Registered May 19th. Capital, £5,000. To acquire the business of an electrical contractor carried on by Harry Tams at Queen's Road, Northwood, Stoke-on-Trent. H. Tams is permanent director. Regd. office: 8, Queen's Road, Northwood.

Smith & Speirs, Ltd.—Registered April 22nd. Capital, £500. To acquire the business of an electrical engineer carried on by W. Smith at Aingarth, Holling Road, Hampsthwaite, Yorks. Directors: W. Smith and R. Speirs. Regd. office: Goodrick Chambers, 1, Cambridge Street, Harrogate.

Parry's (Electrical Engineers), Ltd.—Registered April 23rd. Capital, £5,000. Directors: R. F. Parry, L. Parry, R. P. Parry and Gladys M. Parry. Regd. office: 32, Russell Street, Liverpool, 3.

Diskin & Holden, Ltd.—Registered April 24th. Capital, £100. To acquire the business of electrical and radio engineers and dealers carried on by Diskin & Holden at Westcliff. Directors: S. S. Holden, J. Diskin and D. T. Millett. Regd. office: 370, Station Road, Westcliff, Essex.

S. H. E., Ltd.—Registered April 23rd. Capital, £100. Manufacturers of, and dealers in, electrical fittings, apparatus and accessories, etc. Regd. office: 220-226, Bishopsgate, E.C.2.

Southern Wholesale Electrical (Hove), Ltd.—Registered April 28th. Capital, £1,000. Manufacturers of, and dealers in, electrical, radio, and other equipment, etc. Directors: F. H. Leppard and J. Fielding. Regd. office: 4-5, North Street, Quadrant, Brighton.

Reginald P. Biker, Ltd.—Registered April 29th. Capital, £4,000. To acquire the business of an electrical engineer carried on by R. P. Biker at Hastings. R. P. Biker is one of the first directors.

Vernon Transformer Co., Ltd.—Registered May 5th. Capital, £1,000. To acquire the business of electrical engineers carried on by G. A. Galle and R. R. Vale, at Mill Road, Stourport-on-Severn, Worcs. Directors: G. A. Galle and R. R. Vale. Regd. office: Mill Road, Stourport-on-Severn, Worcs.

Mercury Discharge Lighting Co., Ltd.—Registered May 2nd. Capital, £2,000. Manufacturers and repairers of, and dealers in, fluorescent lighting fittings and components, etc. Directors: V. L. Butler and H. W. Payne. Regd. office: 96a, Holloway Road, N.7.

A. S. Wootton & Co., Ltd.—Registered May 1st. Capital, £5,000. To acquire the business of an electrical engineer carried on by A. S. Wootton at Crewe. Directors: A. S. Wootton and Florence Wootton. Regd. office: 152, West Street, Crewe.

Bourne Electronics, Ltd.—Registered May 1st. Capital, £2,000. Manufacturers of, and dealers in, electrical, radio and mechanical apparatus, etc. Directors: G. Lewis, H. A. Smith and E. W. Durant. Regd. office: 881, Christchurch Road, Bournemouth.

Beam (Electronic Engineers), Ltd.—Registered May 20th. Capital, £4,000. To acquire the business of electronic engineers, etc., carried on at Lewisham as "Beam (Electronic Engineers)." Permanent directors: Marian Burchard, M. G. Mew, O. Dzierzynski, A. Hofman and S. Kruk-Rogald. Regd. office: 233-35, Lewisham High Street, S.E.13.

Hylvic (London), Ltd.—Registered April 12th. Capital, £1,000. Electrical engineers, etc. Directors: V. H. S. Snow and Hylda Snow. Regd. office: 34, Clement's Lane, E.C.4.

Butler & Lloyd, Ltd.—Registered April 2nd. Capital, £5,000. Manufacturers and distributors of electrical fittings, etc. Directors: J. W. Lloyd and Elsie M. Lloyd. Regd. office: 1, Union Row, Handsworth, Birmingham.

Increases of Capital

Midland Dynamo Co., Ltd.—Capital increased by £30,000 in £1 shares, beyond the registered capital of £10,000.

Baldwin & Francis, Ltd.—Capital increased by £150,000 in £1 shares, beyond the registered capital of £25,000.

Bankruptcies

F. R. A. Lock and **V. C. Lock**, carrying on business at Union Street, Stourbridge, under the style of Lock Brothers, electrical engineers.—First and final dividend of 3s. 2d. in the £, payable June 12th at the Official Receiver's offices, 1, Priory Street, Dudley.

F. R. A. Lock (separate estate).—First and final dividend of 20s. in the £, payable June 12th at the Official Receiver's Offices, 1, Priory Street, Dudley.

STOCKS AND SHARES

SOMETHING of a halt has occurred in the rising trend of prices to which attention has been drawn here on various occasions during the current year. British Government securities have shown a distinct tendency to droop, nor is it easy to assign any special reason for the dullness which has overtaken this market. The Labour Party's conference at Margate produced speeches that emphasized the seriousness of the outlook in months that lie ahead; and possibly this has had some indirect influence in serving to inculcate caution on the part of investment at the present time.

Electricity Supply

The Earl of Lytton's speech at last week's meeting of the London Associated Electricity Undertakings covered a wide ground. He pointed out that the Electricity Bill is not yet a statute. "Its progress is receiving the earnest attention of your directors," he went on, "and members are assured that any further steps possible to secure a further settlement will be taken when the Bill comes to be debated in the House of Lords." Lord Lytton also mentioned that the Government is at last taking active steps to increase the production of electricity generating plant.

Price Fluctuations

Tube Investments have crossed £7 again following the news of an agreement with Hawker Siddeleys for a merger of the two companies' aluminium interests. A reaction of 1s. in Automatic Telephones to 81s. 6d. is among the week's few quotable changes in the electrical equipment market. Ever Ready have eased further to 41s. 6d. Deccas, at 60s., improved on further developments in connection with the navigator system, and Cossors recovered to 30s. Scophony, at 5s. 9d., are quoted ex-rights to the new shares. Overseas unrest is reflected in the weakness of Calcutta Electric, at 47s. 6d., and the Tramway stock at 44s. 6d., while Palestine Electrics are also dull. Victoria Falls, at 6, are lower in sympathy with the dullness of the South African mining market. Cable & Wireless ordinary and preference have gone back to 163½ and 116½ respectively. General Cables, at 41s., have gained a further florin. Allen Wests, at 11s. 9d., are 1s. 6d. up, and Telephone Manufacturing have risen 1s. to 16s. 9d.

B.E.T. 100 up

New issues continue to be well supported on the whole. Premiums on the issue prices develop in the majority of cases, and it is known that the pigeon-holes of promoters' offices are well stored with further offers which are to be made as and when opportunity serves.

One good feature during the past few days has been a substantial improvement in the prices of British Electric Traction deferred stock, which has advanced 100 points to 1345, and in Thomas Tilling shares, which show a rise of 5s. 6d. at 63s. 6d. These advances are due to the impression that the shares of companies concerned with provincial traction enterprise may be treated on a basis of assets, instead of the takeover prices being governed by Stock Exchange quotations.

British Insulated

Although still subdued by a measure of disappointment over last month's dividend, British Insulated Callender's ordinary stock remains quoted on a yield basis of under 3 per cent. The present 45s. ex dividend compares with 52s. 6d. shortly before the declaration of the 6 per cent final dividend. This, it will be remembered, made a total of 10 per cent for the eighteen months ended last December, equivalent to a rate of 6⅔ per cent per annum. At the time of the announcement, it was officially explained that the first accounts covered conditions which were abnormal, not only because of the amalgamation, but also on account of the war-to-peace transition phase. From the relatively low yield on the stock, based on the current dividend, it is clear that these considerations are given their due weight in the market's assessment of the outlook.

"Emmies"

A fall in Electric & Musical Industries 10s. shares to 22s. 6d.—the lowest of the year—attracted buyers, who quickly restored the price to 25s. On the 8 per cent distributions of the last few years the shares now show a yield of £3 4s. 0d. per cent. The financial year ends in September: last year, the annual dividend was declared a month later. Although the accounts do not disclose separately the liability of the group to E.P.T., the market view is that earnings will benefit appreciably from the substitution of the new company taxes. This is deduced from the fact that last year's total taxation took £562,000, leaving less than £200,000 as the group's net profit.

Company Meetings

At the recent annual meeting of London Electric Wire, the chairman spoke of the inequitable result of the Chancellor's imposition of the extra 7½ per cent tax on profits distributed in dividends, and of the 10 per cent duty on bonus issues. In both cases, he points out, the brunt falls on the ordinary shareholders, who have already contributed to the security of the prior charges by the retention of profits ploughed back. Both he and Mr. Waites, at the Johnson & Phillips meeting, referred to record order books, and to the all too familiar shortage of men and materials which handicaps at every turn the task of fulfilling the business. London Electric Wire £1 shares, now just under 50s., have remained a good market since the raising of the distribution from 7½ to a still conservative 10 per cent, on which they yield 4 per cent. On Johnson & Phillips at 82s. 6d. the yield is £3 12s. 6d. per cent.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *may be obtained from the Patent Office*, 25, *Southampton Buildings, London, W.C.*2.

AKT.-GES. Brown, Boveri & Cie.—" Exhaust gas turbo-charger." 30364/45. November 15th, 1944. (588078.) " Gas-blast electric circuit breakers." 2706/45. September 15th, 1943. (588182.)

R. S. Amplifiers, Ltd., and G. H. O. Gasson.—" Electro-magnetic pick-up devices for use with stringed musical instruments." 2660. February 2nd, 1945. (588178.)

Automatic Telephone & Electric Co., Ltd., W. Saville and M. O. Williams.—" Electrical resistance measuring arrangements." 2535. February 1st, 1945. (588162.)

Automatic Telephone & Electric Co., Ltd., H. Milhench, B. C. Gresty and E. E. Comfort.—" Multi-point electrical connectors." 2625. February 2nd, 1945. (588172.)

C. B. Backer.—" Electric heating element." 24425/44. December 9th, 1943. (588051.)

G. E. Bacon.—" Electromagnetic wave guides." 2395. January 30th, 1945. (588122.)

C. Baker.—" Electrical connector." 2218/44. January 18th, 1943. (588245.)

Berkeley & Young, Ltd., and N. W. Gilbert.—" Electric ceiling and like fans." 800. January 10th, 1945. (588276.)

R. I. Bradley.—" Temperature measuring instruments." 2979. February 6th, 1945. (588218.)

British Thomson-Houston Co., Ltd.—" Protective systems for electric traction motors." 10266/43. June 27th, 1942. (588087.) " Electron microscopes." 2366/45. February 1st, 1944. (588119.) " Electron microscopes." 2367/45. February 1st, 1944. (588120.)

British Thomson-Houston Co., Ltd., and W. S. Melville.—" Liquid filled electrical apparatus." 21974. November 8th, 1944. (588263.)

British Thomson-Houston Co., Ltd., and T. H. Petch, jun.—" Electric control systems for electric motors, steam engines and other prime movers." 2888. February 5th, 1945. (588209.)

H. Butler, Ltd., and H. Butler.—" Measuring or indicating instruments." Cognate applications 14414/43 and 13980/44. September 3rd, 1943. (588240.)

Bylock Electric, Ltd., and A. L. Story.—" Vacuum cleaners or sweepers." Cognate applications 2417/45 and 324/46. January 31st, 1945. (588124.)

Chamberlain & Hookham, Ltd., S. James and W. F. Braines.—" Electrical relays." 2604. February 1st, 1945. (588169.)

Chamberlain & Hookham, Ltd., S. James, W. F. Braines and S. Slingsby.—" Protective apparatus for polyphase electricity distributing systems." 2171. January 27th, 1945. (588068.)

Dowsing Co. (Electrical Manufacturers), Ltd., A. J. Gunn and Callinan Giles & Co., Ltd.—" Electrical heating apparatus." 8803. May 9th, 1944. (588142.)

E.I. du Pont de Nemours & Co.—" Baths for electroplating with zinc or alloys consisting principally of zinc." 23587/44. November 25th, 1943. (588268.)

Furzehill Laboratories, Ltd., F. R. Milsom and S. Smith & Sons (England), Ltd.—" Control systems for electric motors." 14964. August 4th, 1944. (588038.)

General Electric Co., Ltd., N. R. Bligh, D. M. Heller, L. C. Stenning and A. A. Chubb.—" Apparatus for tuning a variable electrical oscillator." 1755. January 22nd, 1945. (Addition to 576161.) (588193.)

A. S. Green, T. Astley and R. Birchenough.—" Coupling and static electrical earth bonding device for pipes." 2209. January 29th, 1945. (Addition to 566279.) (588072.)

Igranic Electric Co., Ltd., and R. A. West.—" Systems for stopping induction motors." 4426. March 9th, 1944. (588030.)

Jack & Heintz, Inc.—" Electrical calipers." 21993/44. November 8th, 1943. (588047.)

F. Leach and K. Bradshaw.—" Electrical safety switch devices." 5238/44. March 16th, 1945. (588246.)

Mallory Metallurgical Products, Ltd.—" Sparking-plugs." 2221/45. January 29th, 1944. (588074.) " Electrical contact elements or blanks." 2655/45. February 2nd, 1944. (588177.) " Sparking-plugs." 2527/45. February 1st, 1944. (588197.) " Laminated contacts." 2830/45. February 4th, 1944. (588202.)

Metropolitan Electric Supply Co., Ltd., and C. E. Small.—" Electric power and lighting installations." 16735. September 1st, 1944. (588253.)

L. O. Meyer.—" Electric soldering irons." 2944. February 6th, 1945. (588216.)

G. A. Perrin.—" Preventing flashing at conductor gaps of electric traction systems." 17812. July 12th, 1945. (588286.)

Power Jets (Research & Development), Ltd., and R. H. H. Barr.—" Internal-combustion turbine power plants." 5737. March 28th, 1944. (588095.) " Internal combustion turbine power plants." 7742. April 25th, 1944. (588098.)

Power Jets (Research & Development), Ltd., and H. Constant.—" Internal combustion turbine power plants." 7526. April 22nd, 1944. (588097.)

Power Jets (Research & Development), Ltd.,

and A. R. Howell.—" Compressors and turbines." 12247. July 28th, 1943. (588088.) " Internal-combustion turbine power plants." 1807. January 31st, 1944. (588092.)

Power Jets (Research & Development), Ltd., A. R. Howell and W. R Hawthorne.—" Internal-combustion turbine power plants." 7010. April 15th, 1944. (588096.)

Pye, Ltd., and D. Jackson.—" Fitting, particularly for a miniature plug and socket coupling for coaxial cables." 23099. November 21st, 1944. (588110.)

Radio Gramophone Development Co., Ltd., and E. T. Court.—" Control of electric currents flowing for short periods as in welding." 3149. February 7th, 1945. (588282.)

J. T. Randall, H. A. H. Boot and C. S. Wright.—" High frequency electrical oscillators." 13316. August 22nd, 1940. (588185.) " Vacuum or low-pressure electric discharge apparatus." 10707. August 22nd, 1941. (588186.)

Raytheon Manufacturing Co.—" Electron discharge devices." 8057/44. March 6th, 1942. (588141.)

A. M. Reith and C. S. Wright.—" Apparatus for controlling electronic streams in thermionic valves or the like." 14851. November 19th, 1941. (588238.)

B. Schwarz.—" Variable speed electric drives." 2846. February 5th, 1945. (588204.)

Siemens Bros. & Co., Ltd., and R. I. H. Clark.—" Testing arrangements in electric selective switching systems." Cognate applications 2128/45 and 5918/45. January 26th, 1945. (588063.)

Siemens Electric Lamps & Supplies, Ltd., A. J. Meadowcroft and H. W. L. Cumming.—" Hermetic sealing of metal into vitreous material." 2715. February 2nd, 1945. (588184.)

Simplex Electric Co., Ltd., A. F. Davis and F. G. Arnott.—" Conduit fittings for electric conductors." 2401. January 31st, 1945. (588123.)

Standard Telephones & Cables, Ltd.—" Means for the cancellation of stationary images on cathode-ray oscillograph screens." 25262/44. December 20th, 1943. (588155.) " Radio glide path systems for landing aircraft." 17941/43. May 29th, 1942. (588242.)

Standard Telephones & Cables, Ltd., and F. Gray.—" Electrical lead-out arrangements." 2966. February 6th, 1945. (588217.)

Standard Telephones & Cables, Ltd., and S. G. Tomlin.—" Electron velocity modulation devices." 5742. March 28th, 1944. (588247.)

Standard Telephones & Cables, Ltd., and E. O. Willoughby.—" Aerial arrays." 21297. October 31st, 1944. (588044.)

W. E. Stilwell, jun.—" Electric overload protective device." 15035/44. August 12th, 1943. (588144.)

Taylor & Challen, Ltd., and H. D. Challen.—" Power-operated presses." 25752. December 22nd, 1944. (Addition to 585632.) (588190.)

J. Thomson, R. W. Sutton, A. M. Reith and C. S. Wright.—" Tuning systems for high-frequency electrical oscillators, amplifiers, and mixers." 6466. May 20th, 1941. (588237.)

J. M. Towler and F. H. Towler.—" Hydraulically operated electric contact switches." 2166. January 27th, 1945. (588066.)

R. A. R. Tricker, J. H. Burrow and C. S. Wright.—" Cathode-ray tubes." 16048. November 13th, 1942. (588135.)

Veritys, Ltd., and J. W. Forth.—" Appliance for absorbing shocks and vibrations in electric lighting fittings." 2762. February 3rd, 1945. (588201.)

Western Electric Co., Inc.—" Electrical oscillator systems." 1079/44. October 23rd, 1941. (588140.) " Directive antennas." 1236/45. January 15th, 1944. (588159.) " Pulse echo distance measuring devices." 11840/44. June 22nd, 1943. (588187.)

Westinghouse Brake & Signal Co., Ltd., and A. H. B. Walker.—" Control apparatus for alternating electric current circuits." 3094. February 7th, 1945. (588227.)

Industrial Research

Functions of G.E.C. Laboratories

THE functions of and methods of procedure within the G.E.C. research laboratories at Wembley were explained in a paper recently presented at the Royal Society in London by SIR CLIFFORD PATERSON, who has been the director of these laboratories since their foundation in 1919.

Sir Clifford commenced by emphasizing that the rate at which efficient and ordered manufacturing industry could digest diets of innovations and novel products was inevitably limited, much more so than was usually appreciated. He then especially stressed the organizational link with the numerous factories and departments of the company which the laboratories served. The latter were based upon the requirements of the former, so trends had to be watched and a certain amount of long-term research prosecuted. The last mentioned function was very important, though not the primary one for which the Wembley organization existed; it seemed to be a reversal of the more usual set-up in which the industrial laboratory kept all its thoughts and intentions upon new products and processes, tending to regard the giving of scientific service to existing industry as an incidental duty that interfered with more important activities. That difference between objectives might appear to be doctrinaire, but it vitally affected the structure and outlook of the whole laboratories.

The welding into a single team of industrially raw scientists and experienced factory staffs justly proud of their productive skill was the essence of successful industrial research and did much to determine the form of the internal organization of the laboratory.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Aireborough.—June 16th. Urban District Council. Electrical work in 98 houses on Yeadon Hall site. Surveyor, Micklefield House, Rawdon, near Leeds.

Birmingham.—July 1st. Electric Supply Department. Cast-iron pipework, valves, etc., for Hams Hall "B" station. (May 23rd.)

July 1st. One 20-MVA 32/11-kV outdoor transformer. (May 30th.)

Cleethorpes.—July 5th. Corporation. H.v. and l.v. switchgear, transformer and h.v. cable. (See this issue.)

Clun.—July 3rd. R.D.C. Pumps and electrical equipment in connection with water scheme. Jennings, Homer & Lynch, 3 & 5, Church Street, Brierley Hill, Staffs.

Cromer.—July 8th. U.D.C. Electrically driven pumping plant, capacity, 50,000 g.p.h., for waterworks extension. J. C. Mellis & Co., 7-8, Bury Street, London, E.C.3.

Exeter.—June 25th. Electricity Department. 6·6-kV metalclad feeder switchgear. (See this issue.)

Glasgow.—June 11th. Corporation Water Department. Six direct-coupled electrically driven pumps. S. D. Canvin, general manager, Water Department, City Chambers.

Huntingdonshire.—June 16th. County Council. Automatic electric hospital lift for P.A. Institution, Huntingdon. County architect, Walden House, Huntingdon.

Litherland.—June 16th. U.D.C. Electrical work in connection with the improved system of lighting at the ballroom, Town Hall. Surveyor, Town Hall, Sefton Road.

Manchester.—June 23rd. Electricity Committee. Twenty-four 415-V a.c. substation switchboards and two mercury arc rectifier equipments. (See this issue.)

June 30th. Lifting gear for i.d. fans for boilers at Stewart Street power station. (See this issue.)

Plympton St. Mary.—June 14th. Rural District Council. One 500-kVA outdoor transformer. (May 23rd.)

Prestwich.—June 14th. Committee of Visitors. Two feeder panels at Mental Hospital substation. (See this issue.)

Stoke Newington.—June 18th. Borough Council. Six 750-kVA transformers, four l.v. switchboards and four e.h.v. switchboards. (May 30th.)

Orders Placed

Manchester.—Electricity Committee. Accepted. Requirements for twelve months:—Meters.—Ferranti; Measurement; Chamberlain & Hookham. Electric kettles.—Premier Electric Heaters. Service cut-outs.—Parmiter, Hope & Sugden; Siemens Electric Lamps & Supplies. Street lanterns and globes.—Wardle Engineering Co.; Falk, Stadelmann & Co.; Butterworth Bros.; B.T.H. Co.; Revo Electric Co.

The following have been placed on the list of contractors for the Department's requirements for cables for twelve months:—Hackbridge Cable Co.; Telegraph Construction & Maintenance Co.; Connollys (Blackley); Scottish Cables; W. T. Glover & Co.; B.I. Callender's Cables; Johnson & Phillips; Mersey Cable Works; Wholesale Fittings Co.; Sterling Cable Co.

33-kV switchgear, Barton Station.—B.T.H. Co.

Middlesbrough.—Town Council. Accepted. Transformer (347).—Electric Construction Co. Meter testing equipment (£214).—Ferranti.

Stockton-on-Tees.—Town Council. Accepted. Switchgear.—A. Reyrolle & Co., Ltd.; W. Lucy & Co. Transformers.—C. A. Parsons & Co.

Stoke Newington.—Electricity Committee. Recommended. Conversion of consumers' radio apparatus. Contract with Radiomenders, Ltd., extended to March 31st, 1948, subject to a 15 per cent increase in prices.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barrow-in-Furness.—Extensions to works, Barrow Haematite Steel Co., Ltd., Ironworks Road.

Bath.—Houses (42), Twerton estate, for T.C.; A. G. Webb, Ltd., builders, Barn Works, Worcester Park, Surrey.

Bingham.—Houses (42), Bingham and Cliffe-on-Trent; C. W. Kendrick, R.D.C. surveyor, Council Offices.

Bishop's Stortford.—Additions, Haymeads General Hospital; C. H. Aslin, county architect, County Hall, Hertford.

Blackley.—Research laboratories and offices at works, Slacks Road for I.C.I. (Dyestuffs Section), Ltd.; Russell Building & Contracting Co., Ltd., 165, Plymouth Grove, Manchester, 13.

Bournemouth.—Completion of sanatorium at Linford (£132,869) for T.C.; W. T. Nicholls (Southern), Ltd., builders, Tennyson Road, Portswood, Southampton.

Bristol.—Temporary houses (323), Wells Road and Tyning estate; city engineer.

Camberwell.—Permanent dwellings (422), on six sites; Darrell Musker, town clerk, Town Hall, Peckham Road, Camberwell, S.E.5.

Derby.—County primary school, Carlisle Avenue, Littleover; F. H. Crossley, county architect, St. Mary's Gate.

Eastry.—Houses (114) for R.D.C.; H. M. Barker, 16, King Street, Deal.

East Wittering.—Junior and infants' school for West Sussex C.C.; F. R. Steele, county architect, County Hall, Chichester.

Eccles.—Dwellings (100), Alder Park, Gee Lane, and Peel Green Road; borough engineer.

Falkirk.—Extensions (printing works, etc.), for F. Johnston & Co., *Falkirk Herald* office, High Street (£10,600); manager.

Glasgow.—Factory premises, Dunlop Rubber Co., Ltd., Fort Dunlop, Birmingham.

Dwellings for single women, Pollok area (£38,500); city surveyor.

Hebden Royd.—Houses (270), shops and flats, Dodd Naze estate; surveyor, Urban Council Offices, Hebden Bridge.

Hyde.—Canteen, Newton Bank Print Works, for Calico Printers' Association; John W. Swindells, Ltd., builders, New Mills.

Invergordon.—Harbour developments (electric cranes, conveyor plant, etc.) to cost £255,000; county clerk, Dingwall.

Islington.—Block of 24 flats, Queen Margaret's Grove, for B.C.; H. Monson, 120, Moorgate, E.C.2.

Lincolnshire.—Secondary modern girls' school, Kitwood (£114,239) for Holland C.C.; William Wright & Son, builders, Park Street, Lincoln.

Liverpool.—Factory, Huyton; Allan & Co., Ltd.

London.—Buildings, pump-house, offices, etc., Lee Bridge Works (£44,111) for the Metropolitan Water Board; F. R. Hipperson & Son, Ltd., builders, 6, Broad Street Place, E.C.2.

Maidstone. — Conversions at Medway Children's Home, for old people's home (£54,350); Kent county architect, Springfield.

Newcastle-on-Tyne.—Extensions to works of Lloyd's British Testing Co., Ltd., Wincomblee Road; Purdie & Lumsden, Oxford Street.

Norwich.—Houses (110), West Earlham estate; city architect, City Hall.

Oldham.—Secondary school at Robin Hill for E.C.; A. L. Hobson, borough engineer.

Oxford.—Extensions to physics laboratory, Park Road; Lanchester & Lodge, architects, 10, Woburn Square, W.C.1.

Southcourt.—Primary school, Oak Green, Bucks E.C.; county architect, County Hall, Aylesbury.

Stafford.—Houses (200), Doxey site for T.C.; Wilson Lovatt & Sons, builders, Clarence Street.

Stockport.—Special school, Taxal Lodge, Whaley Bridge; Z. & W. Wade (Whaley Bridge), Ltd., builders.

Dye house and offices, Heapriding Mills; John E. Clegg & Son, cotton spinners.

Extensions and alterations to works, Millgate and The Folley; Harvey Briggs (Refrigeration), Ltd.; Major R. Bull, architect, High Street, Cheadle.

Stoke Newington.—Home for the aged at Woodberry Down (£76,100); L.C.C. architect, County Hall, S.E.1.

Stourbridge. — Permanent dwellings (98), Norton estate; G. N. Maynard, borough engineer, Council House.

Wakefield.—New works for Yorkshire Press & Tool Co., Ltd., Church Street, Thornes Lane.

Factory, Horbury Road; Wakefield Shirt Co., Ltd.

Wandsworth.—Extensions to works, Thessaly Road, for Projectile & Engineering Co., Ltd.

West Bromwich.—Factory, Bull Lane; Chetwin, Newark & Co. (1920), Ltd., 150, Birmingham Road.

Willesden.—Flats (96), Canterbury Terrace, and flats (30), Chichester Road, South Kilburn; borough surveyor, Town Hall, Dyne Road, Kilburn, N.W.6.

Additional office accommodation, Ratcliffe Tool Co., Ltd., Gorst Road; builders, A. A. Shaw & Co., Ltd., 105a, Mill Hill Road, W.3.

Next Week's Events

Thursday, June 12th.

LEEDS.—Institution of Electrical Engineers, North Midland Centre. I.E.E. Benevolent Fund Golf Competition at Sandmoor Golf Course.

Friday, June 13th.

LONDON.—St. Stephen's Tavern, Bridge Street, Westminster, 6.30 p.m. E.P.E.A. Meter Engineers' Group (Southern Division). "N.P.L. Testing of Apparatus for Approval in Accordance with Meters Act," by A. Felton, B.Sc. (Eng.), M.I.E.E.

Saturday, June 14th.

LONDON.—Institute of Physics (Electronics Group). Summer meeting on "Cathode Emission."

LONDON. — Women's Engineering Society (London Local Section). 2.30 p.m. Visit to the City & Guilds College, South Kensington, followed by annual general meeting.